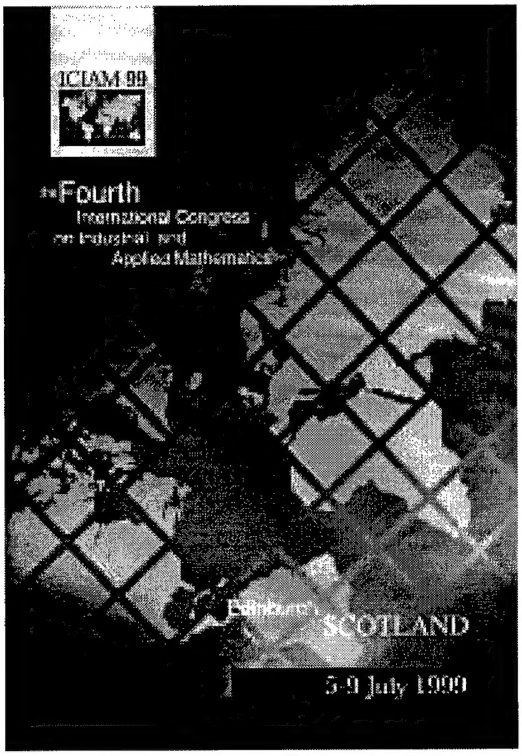

Final Programme

The Programme is correct at the time of going to press (28 May 1999) and is subject to change. The up-to-date version of the Programme is available on the congress Internet site, http://www.ma.hw.ac.uk/iciam99/. The Programme was produced from information provided by the participants. This information was subject only to minor editing.

Printed by Edinburgh Press.

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	1999	Conference Proceedings

4. TITLE AND SUBTITLE

Fourth International Congress on Industrial and Applied Mathematics, Final Programme.

5. FUNDING NUMBERS

F61775-99-WF031

6. AUTHOR(S)

Conference Committee

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Heriot-Watt University
Dept of Mathematics
Edinburgh EH14 4AS
Scotland

8. PERFORMING ORGANIZATION REPORT NUMBER

N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

EOARD
PSC 802 BOX 14
FPO 09499-0200

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

CSP 99-5031-2

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

A

13. ABSTRACT (Maximum 200 words)

The Final Proceedings for Fourth International Congress on Industrial and Applied Mathematics, 5 July 1999 - 9 July 1999

This is an interdisciplinary conference. Topics include mathematical modelling in industry and commerce, mathematics of biology and medicine, cryptography, coding, and computer science, signal and image processing, and electromagnetism, including telecommunications, semi-conductors, and electronics.

14. SUBJECT TERMS

EOARD, Signal Processing, Image Processing, Cryptography

15. NUMBER OF PAGES

231
347

16. PRICE CODE

N/A

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

Congress Venue

The Fourth International Congress on Industrial and Applied Mathematics will take place at the University of Edinburgh, George Square Campus from Sunday 4 July to Friday 9 July 1999. Information about all aspects of the Congress can be obtained from staff at the Chaplaincy Centre which is at 1 Bristo Square.

Patrons

The Joint Patrons of the Congress are H.R.H. The Prince Philip, Duke of Edinburgh, K.G., K.T. and The Right Hon. The Lord Mackay of Clashfern.

Message from the Lord Provost of Edinburgh, Eric Milligan

As Lord Provost of Edinburgh, I am delighted to welcome you to the City for the Fourth International Congress on Industrial and Applied Mathematics. I would like in particular, to welcome those of you who are visiting Edinburgh for the first time. I know that you will have a very busy time attending the Congress, but I do hope that in the course of your visit you will be able to enjoy something of Edinburgh and its many attractions.

Edinburgh is a beautiful, dynamic, prosperous European city, benefiting from a unique architectural heritage and a magnificent natural setting. It is host to many thousands of visitors who come here throughout the year to enjoy numerous cultural and sporting events such as "Edinburgh's Hogmanay" and the Edinburgh International Festival.

Edinburgh is also the home of government, law, the churches and banking in Scotland and enjoys a reputation for academic excellence and for offering a superb quality of life to those who live and work here. With a Scottish Parliament being established in the city for the first time in three hundred years, Edinburgh will enter the next Millennium as a more complete capital city.

I do hope that you will enjoy attending this important Congress in Edinburgh. I hope the Congress will be successful and I hope that you will come back to Edinburgh again on many future occasions whether it be for leisure or business.

Message from the Chairman of ICIAM 99, Sir Michael Atiyah

It is a great pleasure to welcome all the participants to the Fourth International Congress of Industrial and Applied Mathematics. ICIAM 99 follows the tradition of its successful predecessors in Paris (87), Washington (91) and Hamburg (95). We have laid on what we hope you will find an interesting and varied scientific programme We also hope you will enjoy the social occasions and that you will take the opportunity to explore this beautiful city.

Acknowledgements

The Congress is grateful to the following organisations and companies (listed in alphabetical order) for generous financial assistance towards the success of ICIAM 99.

- Bacon & Woodrow
- The Bank of England
- The Bank of Scotland
- Cambridge Environmental Research Consultants Ltd
- Cambridge University Press
- Edinburgh Mathematical Society
- Edinburgh Parallel Computing Centre (EPCC)
- Engineering and Physical Sciences Research Council
- European Office of Aerospace Research and Development, Air Force Office of Scientific Research, United States Air Force Research Laboratory
- Faculty of Actuaries
- Hewlett-Packard
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- The Institute of Mathematics and its Applications (IMA)
- The International Centre for Mathematical Sciences (ICMS)
- Jaguar Cars
- The London Mathematical Society
- Lothian and Edinburgh Enterprise Ltd
- The Metereological Office
- Microsoft
- The Numerical Algorithms Group (NAG)
- Oxford University Press
- Rothschilds
- The Royal Society
- Schlumberger
- Scottish Widows
- Springer Verlag
- Standard Life
- Trinity College, Cambridge

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ANZIAM Australia and New Zealand Industrial and Applied Mathematics

CAIMS/SCMAI Canadian Applied and Industrial Mathematics Society\Société Canadienne de Mathématiques Appliquées et Industrielles

CSIAM Chinese Society for Industrial and Applied Mathematics

ECMI European Consortium for Mathematics in Industry

GAMM Gesellschaft für Angewandte Mathematik und Mechanik

IMA Institute of Mathematics and its Applications

JSIAM Japan Society for Industrial and Applied Mathematics

KSIAM Korea Society for Industrial and Applied Mathematics

NORTIM Nordiska Föeningen för Tillämpad och Industriell Matematik

SBMAC Sociedade Brasileira de Mathemática Aplicada e Computacional

SEMA Sociedad Española de Matematica Aplicada

SIMAI Società Italiana di Matematica Applicata e Industriale

SMAI Société de Mathmatiques Appliquées et Industrielles

SIAM Society for Industrial and Applied Mathematics

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Timetable Structure

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10:30		Johnson, Virga	Pesch, Popescu	Kennedy, Sethian		
11:00	Mini-Symposia	Mini-Symposia, Contributed Lectures and Poster Sessions	Mini-Symposia, Contributed Lectures and Poster Sessions	Mini-Symposia, Contributed Lectures and Poster Sessions	Mini-Symposia	10:05
13:00						12:05
					Mini-Symposia	13:00
14:00 14:45	Friedman, Lenstra	Avellaneda, Bathe	Jameson, Linan	Dongarra, Moffatt, Müller		
14:55 15:40	Merten, Moran	Kikuchi, Tezuka	Berestycki, Pironneau	Hassanzadeh, Keshet, Kida		15:00
					Congress Review and Closing Ceremony	15:20
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18:00						
19:00		19:00 Congress Reception Royal Museum				
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How to use the Programme

The Congress programme consists of plenary lectures, mini-symposia, contributed lectures and posters. The Timetable Structure gives an overview of the programme. To find your way through the programme we suggest that you use the Contents on page 5, the Index of Organisers on page 174 and the Index of Speakers on page 184.

Details of the programme in chronological order begin on page 10. Each day is divided into a morning and afternoon session. An overview followed by a detailed programme is given for each session. The explanation of abbreviations for room names in the overview sections can be found below.

The abstracts of the plenary lectures and the summaries of the mini-symposia are contained in this book, whereas the abstracts of the minisymposia talks, the contributed lectures and the poster presentations are contained in the Book of Abstracts.

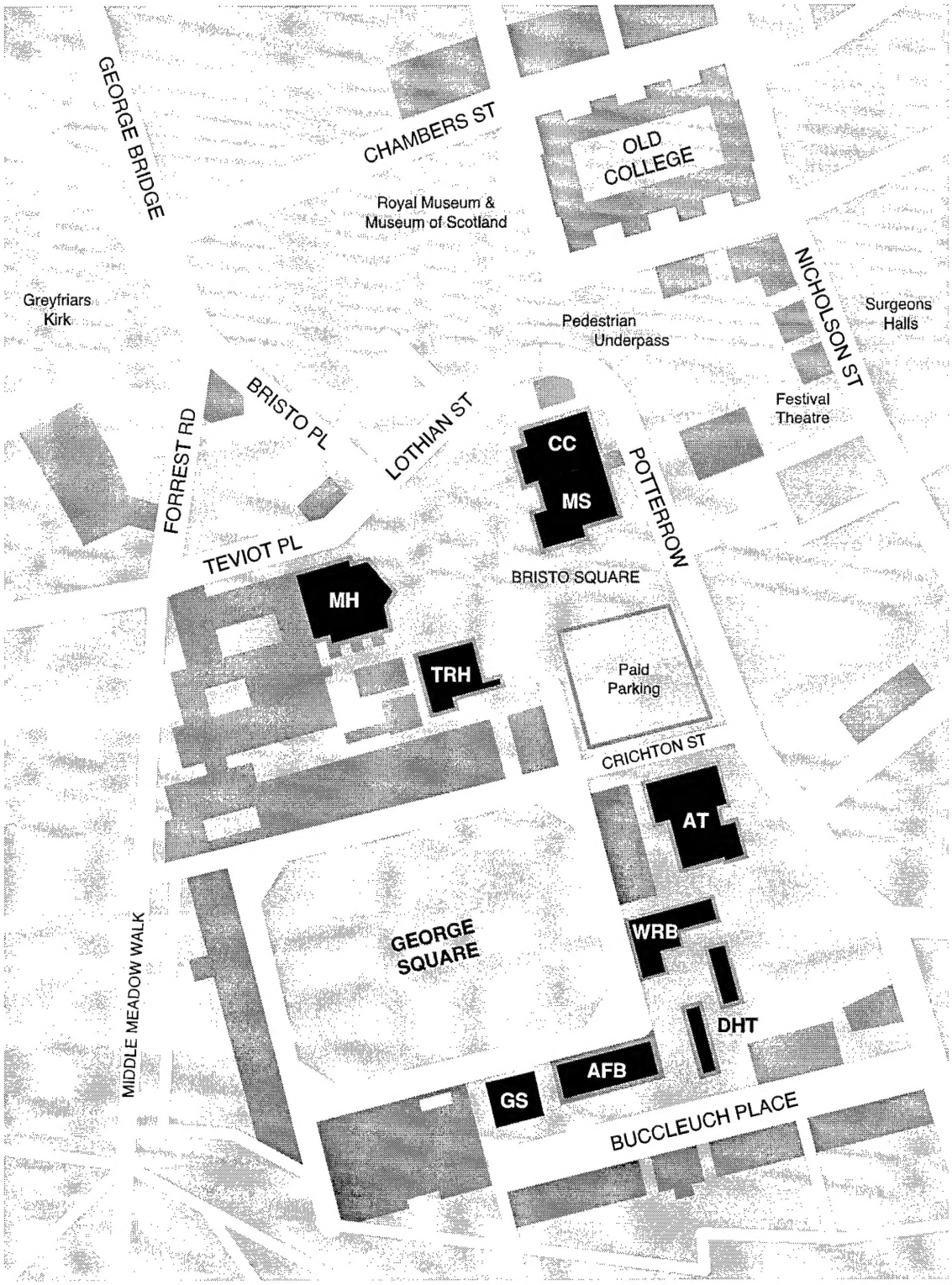
In this book, the page reference in brackets on the right-hand side of the title of a lecture refer to the page number in the Book of Abstracts where the abstract can be found (if submitted to organisers in time).

Because of space limitations, only the name of the presenting speaker is included in the Programme and the Index. Details of co-authors are contained in the abstracts.

The updated electronic version of the Final Programme is available (before, during, and after the Congress) on the ICIAM99 web page,

`http://www.ma.hw.ac.uk/iciam99/`

Site Map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OLD COLLEGE
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NICHOLSON ST
Greyfriars Kirk
Pedestrian Underpass
Surgeons Halls
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POTTERROW
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TRH
Paid Parking
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AT
WRB
GEORGE SQUARE
MIDDLE MEADOW WALK
DHT
AFB
GS
BUCCLEUCH PLACE

Building and Room Codes

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George Square Lecture Theatre	**GS**
Chaplaincy Centre	**CC**
Teviot Row House	**TRH**
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ICIAM 99
5 - 9
July
1999

Monday, 5 July, Morning Session
Overview

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MSP-002	Stochastic Models for Turbulent Diffusion and Environmental Pollution	DHT-S
MSP-011	Applications of Random Dynamical Systems (RDS) I	WRB-10
MSP-013	Nonlocal Elliptic-Parabolic Problems in Reaction-Diffusion Equations	WRB-4
MSP-019	New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials I	WRB-11
MSP-031	Fractals and Scaling in Industrial and Environmental Applications	AT-8
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MSP-040	A-Posteriori Error Estimation and Adaptive Procedures in Finite Elements I	AT-5
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MSP-079	Wave Field Decomposition Methods in Direct and Inverse Scattering I	AT-2B
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MSP-125	The ECMI Special Interest Group on "Mathematics of Polymers" I	MS-1
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MSP-255	Dynamic Problems in Fracture	AFB-19
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MSP-260	Computational Electromagnetics I	DHT-N
MSP-264	Schlumberger Minisymposia Reviews I	WRB-8
MSP-270	Statistical and Deterministic Approaches to Large Scale Problems	WRB-1

Monday, 5 July, Morning Session
Details

09.15 – 10.30 Opening Ceremony

Opening Ceremony — McEwan Hall

ICIAM 99 will be opened by H.R.H. The Prince Philip, Duke of Edinburgh, K.G., K.T, who is a Joint Patron of the Congress.
The Committee for International Conferences on Industrial and Applied Mathematics have established four prizes to recognise outstanding achievments in applied mathematics and these will awarded also at the Opening Ceremony. The Lagrange prize will be awarded to individual mathematicians who have made an exceptional contribution to applied mathematics throughout their career. The Lothar Collatz prize will be awarded to an individual scientist under 42 years of age for outstanding work in industrial and applied mathematics. The SIAM Pioneer Prize will be awarded for pioneering work introducing applied mathematical methods and scientific computing techniques to an industrial problem area or new scientific field of applications. The Maxwell Prize which is funded by the IMA and the James Clerk Maxwell Foundation is to provide international recognition to a mathematician who has demonstrated originality in applied mathematics.
For security reasons, participants are asked to be in McEwan Hall by 9.15am.

11.00 – 13.00 Mini-Symposia

MSP-001 — Appleton Tower, Lecture Theatre 1
Rotary Flows

Organisers: CONLISK, A Terrence (Ohio State University, USA)
SMITH, Frank T (University College London, UK)

Flows generated by rotation of bodies occur in a wide variety of situations. The applications include turbomachinery, helicopters, mixers, natural rotors, and geophysical flows. Often small length scale phenomena are important to resolve in these problems so that a purely computational approach is not feasible. In addition, time scales can be fairly short so that a purely experimental approach is not adequate either. In this mini-symposium, we discuss problems such as boundary layers on rotating blades, the origin of the tip vortex on a rotating blade and the influence of boundary layers in a rapidly rotating fluid from an analytical and computational perspective. Complex flow phenomena which have been observed on helicopter blades and which can impede efficient design of the blades are also presented.

MSP-002 David Hume Tower, Faculty Room South

Stochastic Models for Turbulent Diffusion and Environmental Pollution

Organisers: CHATWIN, Philip C (Applied Mathematics, University of Sheffield, UK)
SULLIVAN, Paul J (Applied Mathematics, University of Western Ontario, Canada)

Turbulent diffusion is the controlling process for much environmental pollution, including that associated with many industrial accidents. But, strictly, it is still an unsolved mathematical problem. Abundant and recent high quality datasets increasingly emphasize the need for models that represent physical reality to be stochastic. The same is true for industrial risk assessment. In this minisymposium, different but complementary mathematical approaches to stochastic modelling will be discussed. A strong common theme will be how basic physics, which controls the probabilities through the basic advection-diffusion equation is incorporated. Another theme will be the comparison with data, requiring novel data-analysis.

MSP-011 William Robertson Building, Seminar Room 10

Applications of Random Dynamical Systems (RDS) I

(see also Part II, MSP-242, p. 36)

Organisers: NAMACHCHIVAYA, N Sri (University of Illinois, Urbana-Champaign, USA)
SOWERS, Richard (University of Illinois, Urbana-Champaign, USA)

During the past ten years there has been a great interest and real progress in stability theory of stochastic systems, stochastic bifurcation theory and large deviation theory. These progress in the theory has led to the development of reliable methods for computing characteristic quantities in random dynamical systems. The emphasis of the proposed Mini-Symposium will be on probabilistic MODELING of Systems, emerging APPLICATIONS of RDS in engineering and economics and NUMERICAL analysis of RDS. Nonlinear behavior, uncertainties, spatial and temporal randomness along with development of methods to analyze the complex interactions between noise, stability, and nonlinearities will be the focus of this Mini-Symposium. The proposed Mini-Symposium will bring together mathematicians, physicists, engineers and economists and emphasize the study of the foregoing problems and interaction between these groups.

MSP-013 William Robertson Building, Seminar Room 4

Nonlocal Elliptic-Parabolic Problems in Reaction-Diffusion Equations

Organisers: CARRILLO, José A (University of Texas at Austin, Texas, USA)
LACEY, Andrew A (Heriot-Watt University, Edinburgh, UK)

In recent years many interesting problems arising in mathematical physics have been modelled by equations with nonlocal terms of integral type. Examples include the stationary distribution of charged or mass particles in statistical mechanics, temperature variation in electrical conduction, and thermo-viscous flow. The minisymposium will demonstrate the use of analytical tools such as comparison functions, imbedding theorems and variational principles to determine properties of solution and qualitative behaviour. It is aimed at applied analysts with interest in physical problems and also scientists who might meet such models in their work.

MSP-019 William Robertson Building, Seminar Room 11

New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials I

(see also Part II, MSP-020, p. 29; Part III, MSP-021, p. 47; Part IV, MSP-022, p. 64; Part V, MSP-023, p. 82; Part VI, MSP-024, p. 102)

Organisers: FONSECA, Irene (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)
KINDERLEHRER, David (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)

This minisymposium brings together scientists working in neighbouring disciplines within the areas of Mechanics, Analysis, and Scientific Computation. Recent advances in the study of materials with underlying mathematical problems at the forefront of traditional theories have motivated new developments in applied mathematics. The goal of this minisymposium is to disseminate current progress in the development of mathematical techniques and physical theory as these contribute to a better understanding of multiple scale structures and multiple scale systems. Topics include microstructure, thin structures, phase transformations, magnetic materials, conservation laws, materials design, and related questions.

MSP-031 Appleton Tower, Seminar Room 8

Fractals and Scaling in Industrial and Environmental Applications

Organisers: GOMATAM, Jagan (Glasgow Caledonian University, UK)
BORODICH, Feodor M (Glasgow Caledonian University, UK)

Many physical, industrial and environmental processes are naturally described as systems which obey the law of bounded dilation similarity. In recent years much attention has been paid to the development of new similarity methods which include fractal approaches, parametric-homogeneity, complex fractal exponents and other scaling and renormalization techniques. The minisymposium reflects the state of the art as well as provides an opportunity to discuss many new results in this field, in particular novel applications of the scaling and fractal methods to problems of fracture, failure predictions, development of probabilistic processes on fractal trees, and the calculation of the physical properties of heterogeneous composites.

MSP-033 Management School, Lecture Theatre 5

Analysis of Boundary Value Problems for PDEs I

(see also Part II, MSP-034, p. 29; Part III, MSP-035, p. 47)

Organiser: KRUTITSKII, Pavel (Moscow State University, Russia)

Similar boundary value problems can be effectively used for mathematical modelling in different areas of natural sciences. The minisymposium gives a survey of a wide range of boundary value problems arising in applications and presents constructive methods for their analysis. These methods enable either to obtain a representation for a solution or to predict its properties and behaviour. The talks are concerned with nonclassical impulse evolutionary problems describing automatic systems in industry, elliptic problems in nonsmooth and cracked domains, aerodynamics problems, such as flow over wings, diffusion and diffraction problems. Constructive methods to be discussed at minisymposium include methods of functional analysis and qualitative theory for general problems, methods of local analysis, Neumann series, separation of variables in nonclassical problems, analysis of integral and pseudodifferential equations associated with boundary value problems in case of nonsmooth and complicated domains. Special emphasis will be given to the theory of singular integral equations and to construction of their approximate solutions.

MSP-037 Management School, Lecture Theatre 4

Integral Transforms, Spectral Representation, Boundary Value Problems and the D-Bar Problem

Organisers: FOKAS, Athanasios S (Department of Mathematics, Imperial College, UK)
PELLONI, Beatrice (Department of Mathematics, Imperial College, UK)

The "inverse scattering" or "inverse spectral method" is a nonlinear Fourier transform method, which can be used for the solution of initial value problems for integrable nonlinear PDE's. Recently, this method has been extended to the solution of boundary value problems in arbitrary domains. It is interesting that these results have motivated the discovery of a new transform method for solving linear PDE's in two variables. The new method can be used to solve problems with complicated boundary conditions and/or complicated domains. This development unifies and extends several branches of classical applied mathematics: the classical transform method for simple linear PDE's, the solution of linear PDE's by the Wiener-Hopf and other similar techniques, the treatment of integral nonlinear PDE's; furthermore it extends those results to arbitrary domains. Applications include fluid mechanics, acoustics and elasticity.

MSP-040 Appleton Tower, Lecture Theatre 5

A-Posteriori Error Estimation and Adaptive Procedures in Finite Elements I

(see also Part II, MSP-041, p. 29)

Organisers: BABUSKA, Ivo M (The University of Texas at Austin, USA)
STROUBOULIS, Theofanis (Texas A&M University, USA)

The quality of the computed data of interest is essential in the numerical treatment of PDE'S in engineering and scientific computations. The goal of the a-posteriori error estimations is to obtain accurate and close upper and lower estimates of the error in the computed data of interest. In the recent years, progress has been made especially in solving elliptic equations with applications in solid mechanics. The aim of the adaptive procedures is to obtain desired results in the range of prescribed accuracy in the cheapest way. Most present approaches have a heuristic character or at best are asymptotic. The talks will present the state-of-the-art in theory, computations and engineering applications.

MSP-057 William Robertson Building, Seminar Room 9

Kinetic and Gas Dynamic Models for the Simulation of Semiconductor Devices and their Manufacturing Processes I

(see also Part II, MSP-253, p. 36)

Organiser: RINGHOFER, Christian (Arizona State University, USA)

Kinetic models for semiconductor device and process simulation model charged particle flow via the Boltzmann equation (BE). While the BE gives a relatively accurate physical description, the large computational cost limits its use as a simulation tool. Therefore the BE is frequently replaced by gas dynamic models, derived from the BE through asymptotics and moment closures. This is the case for the simulation of electron flows in a given device as well as for the diffusion and deposition processes used in the manufacture of devices. This mini-symposium gives an overview over recent work on fluid models and their relation to the underlying kinetics from an analytical and numerical perspective.

MSP-071 David Hume Tower, Room 4.18
New Numerical Methods for Geometrical Optics

Organiser: BENAMOU, Jean-David (INRIA, France)

The numerical limitations of the classical ray tracing method are either linked to the existence of low density zones where very few rays enter or, on the contrary, to the apparition of multivalued traveltimes when rays are crossing near caustics. The mini-symposium will present recently proposed alternate algorithms. They are either based on a new resolution technique of the associated "kinetic" Liouville equation or on the direct discretization and resolution of the Eikonal equation with ad-hoc treatment of multivalued travel-times.

MSP-079 Appleton Tower, Room 2B
Wave Field Decomposition Methods in Direct and Inverse Scattering I
(see also Part II, MSP-080, p. 29; Part III, MSP-081, p. 50)

Organisers: KARLSSON, Anders (Department of Electromagnetic Theory, Lund Institute of Technology, Sweden)
FISHMAN, Louis (Naval Research Laboratory, USA)

This minisymposium addresses both direct and inverse scattering problems of applied and industrial interest in acoustics, electromagnetics, and elastodynamics. Wave field decomposition, which correctly captures the kinematics of a scattering experiment, provides the unifying theme for the one- and multi-dimensional spatial formulations in both the time and frequency domains which are considered. In conjunction with key ideas from invariant imbedding (reflection and transmission operators), Green's functions, wave propagators, Dirichlet-to-Neumann operators, pseudodifferential and Fourier integral operators, and path integrals, theoretical results, exact solution cases, and extensive numerical calculations for a variety of direct and inverse algorithms are developed.

MSP-087 William Robertson Building, Seminar Room 2

The Dynamics of Granular Materials: Physical Modeling and Mathematical Analysis I

(see also Part II, MSP-088, p. 30)

Organisers: PITMAN, E Bruce (Dept of Mathematics, State University of New York, Buffalo, USA)
SHEARER, Michael (Dept of Mathematics, North Carolina State University, Raleigh, USA)

The physical properties of granular materials are understood only to a limited extent. Nonetheless, engineers have formulated constitutive models that purport to describe the behavior of such materials. Many models have been tested by experiment, and investigated both theoretically and with computer simulation. The field of granular materials is enjoying a period of intense activity among Physicists and Engineers, with increasing interest from Mathematicians. Recent developments to be addressed at the minisymposium include new theories of plasticity to model soils and rocks, discrete models to represent stress distributions in a granular material, numerical simulations of granular flow in hoppers, and two phase flow models for granular materials. This minisymposium brings together mathematicians, physicists and engineers, whose talks will address various aspects of the modeling, analysis, and computation of problems involving the deformation and flow of granular materials. These problems will typically be explored in the contexts of experimental results and industrial applications. The focus of the minisymposium is on the formulation of constitutive laws and models, and the mathematical properties of the resulting equations, including analysis and computation.

GREMAUD, Pierre (North Carolina State University, USA) *Numerical simulations of granular flows in hoppers* (p. 89)
SLEMROD, Marshall (Center for Mathematical Sciences, University of Wisconsin, Madison, USA) *Generalized rational approximation and Chapman Enskog expansion* (p. 90)
HAYES, Brian T (Stevens Institute of Technology, USA) *Response of a finite-depth saturated soil to a single-pulse disturbance* (p. 89)
SHEARER, Michael (North Carolina State University, USA) *Properties of granular materials* (p. 89)
OSINOV, V A (University of Karlsruhe, Germany) *Dynamic problems for granular media based on hypoplasticity* (p. 89)

MSP-090 David Hume Tower, Room 4.01

Differential Algebraic Equations and Descriptor Systems

Organisers: MEHRMANN, Volker (TU Chemnitz, Chemnitz, Germany)
KUNKEL, Peter (Univ. Oldenburg, Oldenburg, Germany)

Differential algebraic systems play currently an important role in the modelling, analysis, simulation and control in many applications such as mechanical multibody systems, electrical networks or chemical engineering. While there has been significant progress in this area in the last 25 years, there are still some widely open problems. These concern the analysis and numerical solution of heterogeneous systems like for example coupled systems of different types of partial differential equations, ordinary differential equations and algebraic constraints and also the treatment of over- and underdetermined systems as they arise in control. In this minisymposium some recent developments in the analysis and numerical solution of general differential algebraic systems are presented.

CAMPBELL, Stephen L (North Carolina State University, USA) *Numerical DAE integrators and control* (p. 91)
KUNKEL, Peter (Univ. Oldenburg, Oldenburg Germany) *Numerical solution of over and underdetermined differential algebraic equations* (p. 91)
STÖVER, Ronald (Zentrum für Technomathematik, Universität Bremen, Germany) *A new collocation method for solving linear differential-algebraic BVP* (p. 91)
SIMEON, Bernd (FB Mathematik, TU Darmstadt, Germany) *Weak descriptor forms for constrained motion in elastodynamics* (p. 91)

MSP-100 Appleton Tower, Lecture Theatre 3
Detailed Mathematical Modeling of Reactive Flows

Organisers: MASSOT, Marc (CNRS, Equipe d'Analyse Numérique, Université Lyon 1, France)
GIOVANGIGLI, Vincent (CMAP/CNRS, Ecole Polytechnique, France)

The purpose of this mini-symposium is to present recent developments on mathematical modeling of multicomponent reactive flows involving complex phenomena appearing in combustion processes. Typical of these flows are models describing detailed transport, complex chemistry, gas-surface interaction, developing instabilities. These fundamental studies have been made possible in the last few years by the increasing interaction of mathematics and physics of combustion, yielding results having an impact on both theory and applications.

GIOVANGIGLI, Vincent (CMAP/CNRS Ecole Polytechnique, France) *Plane laminar flames with detailed transport and complex chemistry* (p. 100)
VOLPERT, Vitaly (University Lyon 1, France) *Influence of natural convection on stability of reaction fronts* (p. 100)
MASSOT, Marc (CNRS, Equipe d'Analyse Numérique, Université Lyon 1, France) *Asymptotic stability of equilibrium states for multicomponent reactive flows with detailed transport and complex chemistry* (p. 100)
ERN, Alexandre (CERMICS, ENPC, France) *Detailed modelling of chemical vapor deposition* (p. 100)

MSP-103 Appleton Tower, Lecture Theatre 4
Optimal Targeted Network Approximations of PDE Solutions I
(see also Part II, MSP-104, p. 32)

Organisers: INGERMAN, David (Courant Institute of Mathematical Sciences, USA)
DRUSKIN, Vladimir (Schlumberger-Doll Research, USA)

Historically difference scheme approximation methods focused on global error minimization of solutions of PDEs. For many practical problems, though, the approximation is needed only at specified regions where the measurements are made. Important examples of such problems are approximations of Dirichlet-to-Neumann maps for inverse problems solving and modelling with application to non-destructive testing in geophysics and medical tomography. The focus on targeted error minimization rather then on global one greatly improves the approximations and leads to many intriguing problems in mathematics from combinatorics to linear algebra and homogenization.

DRUSKIN, Vladimir (Schlumberger-Doll Research, USA) *Gaussian spectral rules for three-point second differences and their application to numerical solution of PDEs* (p. 103)
MORROW, Jim (University of Washington, Seattle, USA) *Continuous and discrete Dirichlet-to-Neumann maps for a plane region* (p. 103)
VOGELIUS, Michael (Rutgers University, USA) *A homogenization result linking discrete networks to continuous conductors*
BORCEA, Liliana (Rice University, USA) *Matching pursuit for imaging high contrast conductive media* (p. 102)
ISAACSON, David (Math Dept. RPI, Troy, USA) *Problems in electrical impedance imaging* (p. 103)

MSP-108 David Hume Tower, Lecture Theatre C
History Dependent Material Behavior: Constitutive Models and Mathematical Analysis

Organiser: ALBER, Hans D (Darmstadt University of Technology, Germany)

To utilize the capacity of fast computers and of the finite element analysis in computing the deformation and stress distribution in metallic structures, constitutive equations are needed which model the properties of metals with sufficient accuracy. In mechanics and the engineering sciences, therefore, often rather complex constitutive equations have been developed in the past twenty years. The aims of this mini-symposium are to discuss the mathematical analysis of initial-boundary value problems containing such constitutive equations, and, from the engineering point of view, to discuss the identification of parameters in these constitutive equations.

RASCLE, Michel (Université de Nice, France) *Global L^2 solutions to dynamical elasto-plasticity* (p. 107)
SOFONEA, Mircea (Université de Perpignan, France) *Variational analysis of some contact problems for elastic-visco-plastic materials* (p. 107)
CHELMINSKI, Krzysztof (Darmstadt University of Technology, Germany) *On initial-boundary value problems in the theory of inelastic deformation of metals* (p. 106)
SEDLAN, Konstantin (Universitaet Gesamthochschule Kassel, Germany) *Nonlinear viscoelasticity of elastomers: Constitutive modelling and experimental identification* (p. 107)

MSP-123 David Hume Tower, Room 3.01
Nonlinear and Dynamical Signal Processing

Organisers: KADTKE, James B (Scripps Institute of Oceanography, San Diego, USA)
MCLAUGHLIN, Stephen (Dept of Electronics and Electrical Engin, University of Edinburgh, UK)

Because of several theoretical advances in the last two decades, and the accessibility now of great computational power, a variety of new methods have surfaced which attempt to recover and utilize nonlinear and/or dynamical information from data. In particular, a need generally now exists to develop these techniques in a more rigorous manner, which allows direct application to real-world problems, and includes approaches for optimal design, calculation of asymptotic performance measures, feature extraction, and the like. In this session, the speakers will present several such ideas in the areas of modeling, detection/classification, and inverse problems, and discuss various issues related to their application to real data.

MCLAUGHLIN, Stephen (Dept of Electronics and Electrical Eng, University of Edinburgh, UK) *Nonlinear dynamics in speech synthesis and characterisation* (p. 119)
ROBINSON, John W C (Natl. Defence Research Est., Sweden) *Information theoretic distance measures in stochastic resonance* (p. 120)
STARK, Jaroslav (University College London, UK) *A Takens Embedding Theorem for stochastic systems* (p. 120)
BROOMHEAD, David S (University of Manchester Institute of Science and Technology, UK) *Embedding, oversampling and the estimation of nonlinear channels* (p. 119)
PENTEK, Aron (Marine Physical Laboratory of the Scripps Institution of Oceanography University of California, USA) *Nonlinear classification of time series using dynamical models* (p. 120)

MSP-125 Management School, Lecture Theatre 1
The ECMI Special Interest Group on "Mathematics of Polymers" I
(see also Part II, MSP-126, p. 34)

Organiser: CAPASSO, Vincenzo (Dept of Mathematics, University of Milan, Italy)

Polymer industry raises a large amount of relevant mathematical problems with respect to the quality of manufactured polymer parts. These include in particular questions about: (i) production of the polymeric material from a monomer (based on the Ziegler-Natta catalytic process), (ii) crystallization kinetics of the polymer melt, (iii) the coupling of the crystallization process with the fluid dynamics of the manufacturing process like extrusion, injection moulding or film blowing, etc. In crystallization processes, the final morphology of the crystallized material is a fundamental factor in the physical properties of a solidified part. Also the long term behaviour of such properties (dimensional stability, physical ageing, ...) is strongly influenced by the microstructure of the crystallized material. This mini-symposium is aimed at a unified presentation of some mathematical problems which arise in connection with the above mentioned processes. The group of speakers participate in the ECMI initiative of establishing an interdisciplinary and transnational Special Interest Group on the subject. All centers linked to this SIG operate in close relationship with European Industries involved in the production and manufacturing of polymeric materials. We may like to stress that polymer industry has indeed a centre of excellence in Europe, so that we may and in fact we do really participate in supporting its high competitivity.

EDER, Gerhard (Institute of Chemistry, Linz University, Austria) *Morphological characteristics in the modelling of crystallization kinetics* (p. 122)
BURGER, Martin (Industrial Mathematics Institute, University of Linz, Austria) *Modelling multi-dimensional crystallization of polymers in interaction with heat transfer* (p. 121)
GRAMBERG, Heike J J (Eindhoven University of Technology, The Netherlands) *Instablities in industrial processes for polymer products.* (p. 122)
MANCINI, Alberto (Dip. di Matematica "F.Enriques", Milano, Italy) *Isobaric solidification processes of molten polymers* (p. 122)

MSP-150 Adam Ferguson Building, Room 10

New Challenges in Modeling Active Sensors/Actuators in Structures and Materials

Organisers: DELFOUR, Michel C (Centre de Recherches Matheématiques, Canada)
CAGNOL, John (Ecoles des Mines de Paris, France)

Devices such as piezoelectric patches or orientation of fibers inside a material are used to achieve sensing/control. They are found in various industrial applications ranging from pure actuators, to damping mechanisms or to shape the material as in the theory of formability.

BERNADOU, Michel (Pôle universitaire Léonard de Vinci and INRIA, France) *Some results on modelization and approximation of piezoelectric thin shells* (p. 141)
HANSEN, Scott (Iowa State University, USA) *Modeling and control of plates with localized piezoelectric patches* (p. 141)
HENROT, Antoine (Ecole des Mines and Institut Elie Cartan Nancy, France) *Optimization of the shape of the actuators in an internal control problem* (p. 141)
RAOULT, Annie (IMAG, France) *Relaxation results and applications to nonlinear shell models with directors* (p. 141)
RUSSELL, David (Virginia Tech, USA) *Issues in the formation of plates and shells by means of attached and embedded actuators* (p. 142)

MSP-168 Appleton Tower, Lecture Theatre 2

Nonlinear Gravity-Capillary Free Surface Flows I

(see also Part II, MSP-226, p. 35)

Organiser: VANDEN-BROECK, Jean-Marc (University of East Anglia, UK)

Time dependent and steady gravity-capillary nonlinear free surface flows have many intriguing properties. One of them is the importance played by exponentially small terms. We will describe recent advances in which effects such as non-newtonian properties of the fluids, highly nonlinear jets and ripples in the far field are included. Applications to the impact of sea waves against coastal structures, moving contact lines, the Saffman-Taylor problem, and the selection of physically relevant solutions will be discussed.

BEN AMAR, Martine (Laboratoire de Physique Statistique, Ecole Normale Superieure, France) *Finger-fracture behaviour of a shear-thinning fluid in a Hele-Shaw cell* (p. 156)
CHAPMAN, S Jonathan (Mathematical Institute, Oxford University, England) *Capillary waves in zero gravity ploughing flows* (p. 156)
COOKER, Mark J (University of East Anglia, UK) *Some theoretical and computational work on violent jet flows* (p. 156)
TUCK, Ernest O (The University of Adelaide, Australia) *A generalisation of the Benjamin-Ono equation* (p. 157)

MSP-187 Management School, Lecture Theatre 3

Reduced-Order Modeling of Large-Scale Systems and Applications in Industry

Organiser: FREUND, Roland W (Bell Laboratories, Lucent Technologies, Murray Hill, USA)

Many physical systems can be modeled as linear dynamical systems. Often, the state-space dimension of the system is so large that it becomes prohibitive to tackle the original dynamical system, and instead, in numerical simulations, suitable reduced-order models with significantly smaller state-space dimensions are used. The speakers in this mini-symposium will present recent advances in the area of reduced-order modeling for large-scale linear dynamical systems and discuss the use of reduced-order models in industrial applications, such as the simulation of VLSI circuits and communication systems. Special emphasis will be on reduced-order modeling techniques based on Krylov-subspace methods.

RUHE, Axel (Chalmers University of Technology, Göteborg, Sweden) *Rational Krylov algorithms for eigenvalue problems and model reduction* (p. 172)
FREUND, Roland W (Bell Laboratories, Lucent Technologies, Murray Hill, USA) *Passive reduced-order modeling for VLSI interconnect analysis* (p. 171)
PHILLIPS, Joel R (Cadence, San Jose, USA) *Model-extraction technology for RF communications systems analysis* (p. 171)
NUNNARI, Giuseppe (Universitá di Catania, Catania, Italy) *Reduced-order modeling by non-integer order equations* (p. 171)
BAI, Zhaojun (University of Kentucky, Lexington, USA) *Adaptive error estimation of reduced-order modeling of linear dynamical systems via Krylov-subspace techniques* (p. 171)

MSP-255 Adam Ferguson Building, Room 19
Dynamic Problems in Fracture

Organisers: MOVCHAN, Alexander B (Department of Mathematics, University of Liverpool, UK)
WILLIS, John R (DAMTP, University of Cambridge, UK)

The results presented will cover problems for cracks propagating in a three-dimensional elastic medium and diffraction problems. Presentations relating to propagating cracks will include discussion of the stability of a propagating crack, "crack front waves" and the development of crack front disorder. The diffraction problems presented at the mini-symposium will include analysis of waves propagating across an elastic diffraction grating composed of periodic cracks. The lectures will be of interest to both applied mathematicians and engineers.

ABRAHAMS, I David (University of Manchester, UK) *Scattering by a periodic array of cracks* (p. 217)
ORTIZ, Michael (California Institute of Technology, USA) *Application of cohesive theories to dynamic fracture and fragmentation* (p. 218)
CRASTER, Richard (Imperial College, London, UK) *Pulse scattering by subsurface cracks* (p. 217)
WILLIS, John R (Department of Applied Mathematics & Theoretical Physics, Cambridge University, UK) *Dynamic weight functions for a crack propagating in a viscoelastic medium* (p. 218)
MOVCHAN, Alexander B (University of Liverpool, UK) *Asymptotic models of dynamic cracks propagating on an interface* (p. 217)

MSP-257 David Hume Tower, Lecture Theatre B
Evaluating Integral Functionals from CFD Calculations - Superconvergence, Error Analysis, Adaptation

Organisers: GILES, Michael B (Oxford University Computing Laboratory, UK)
SÜLI, Endre (Oxford University Computing Laboratory, UK)

In many engineering and scientific applications involving the numerical solution of PDEs, there is particular interest in the accurate computation of integral functionals of the computed solution. Lift and drag in CFD applications are prime examples. The talks in this minisymposium address the issue of error analysis for such functionals, and how the accuracy can be improved through grid adaptation or other means.

MACHIELS, Luc (MIT, USA) *A posteriori finite element bounds for output functionals of the incompressible Navier-Stokes equations* (p. 219)
BRAACK, Malte (INRIA, France) *Application of weighted residual error estimates to adaptive mesh refinement* (p. 219)
SÜLI, Endre (Oxford University, UK) *A posteriori error estimation for stabilised finite element approximations of hyperbolic problems* (p. 219)
GILES, Michael B (Oxford University, UK) *Improved lift and drag estimates using adjoint Euler equations* (p. 219)

MSP-260 David Hume Tower, Faculty Room North

Computational Electromagnetics I

(see also Part II, MSP-261, p. 37)

Organisers: MORGAN, Kenneth (University of Wales, Swansea, UK)
MCCOWEN, Andy (University of Wales, Swansea, UK)

The objective is to consider the application of numerical methods to electromagnetic problems of interest to the aerospace industry. In this area, the analyst is frequently faced with problems which can be computationally very large and, for this reason, the feasibility of undertaking a simulation may be determined by the choice of the numerical method to be employed.

JONES, Christopher C R (British Aerospace, Military Aircraft and Aerostructures, UK) *To be announced*
PERIAUX, Jacques (Dassault Aviation, Paris, France) *Multicriteria RCS minimization of active reflectors using genetic algorithms and game theory*
MURPHY, John A (British Aerospace, Sowerby Research Centre, UK) *A review of computational electromagnetics in the aerospace sector* (p. 222)
PARROTT, Kevin (University of Greenwich, UK) *Applications of the adjoint method to high frequency electromagnetic computations* (p. 222)

MSP-264 William Robertson Building, Lecture Theatre 8

Schlumberger Minisymposia Reviews I

(see also Part II, MSP-265, p. 37)

Organisers: BURRIDGE, Robert (Schlumberger-Doll Research, USA)
COVENEY, Peter V (Department of Chemistry, Queen Mary & Westfield College, University of London, UK)

Those two Minisymposia on Finance and Biology are sponsored by Schlumberger Oilfield Services to further enrich our exposure to modern applications of mathematics.

HODGES, Stewart (Warwick Business School, University of Warwick, UK) *What's going on in financial derivatives?* (p. 224)
AUSTIN, Daren (Oxford University, UK) *Mathematical models of infectious disease: From populations to individuals* (p. 224)
COWAN, Jack D (Mathematics Department, University of Chicago, USA) *Neural networks* (p. 224)

MSP-270 William Robertson Building, Seminar Room 1

Statistical and Deterministic Approaches to Large Scale Problems

Organiser: BARTON, Noel G (CMIS, North Ryde)

Applied mathematicians usually approach industrial or scientific problems from a deterministic standpoint. This involves development of equations which model the system, solving the equations by appropriate methods, comparison of model with experiment, and finally use of the model for predictive purposes. On the other hand, model equations are only a representation of reality, and variability is a key feature in some systems. Variability can occur because of random events such as sampling, infection or mutation, or because parameters involved in deterministic systems are known imprecisely. The discussion session explores these complementary approaches to large-scale systems.

JOLIFFE, Ian T (University of Aberdeen, UK) *Statistical modelling in atmospheric and other environmental sciences* (p. 226)
SANDLAND, Ron (Chief, CSIRO Mathematical and Information Sciences) *Deterministic or stochastic? Choosing a modelling approach that works* (p. 227)
CLEARY, Paul W (CSIRO Mathematical and Information Sciences, Australia) *Deterministic and statistical models for industrial granular flows* (p. 226)
GLASBEY, Chris A (Biomathematics and Statistics Scotland, UK) *Deterministic and statistical approaches to image analysis* (p. 226)

ICIAM 99
5 - 9 July 1999

Monday, 5 July, Afternoon Session
Overview

	14.00 – 14.45 Plenary Lectures	
	Avner FRIEDMAN, *Propagation of Cracks in Elastic Media*	MH
	J K LENSTRA, *Whizzkids: Two Exercises in Computational Discrete Optimization*	GS
	14.55 – 15.40 Plenary Lectures	
	K MERTEN, *How to Survive in Industry*	MH
	William MORAN, *Sampling and Interpolation of Signals with Multi-Band Spectra*	GS
	16.00 – 18.00 Mini-Symposia	
MSP-012	Mixing with Chaos: Fundamentals, Applications, New Directions	AT-1
MSP-014	Nonlinear Waves in Solids: Analytical and Numerical Aspects I	DHT-C
MSP-020	New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials II	WRB-11
MSP-034	Analysis of Boundary Value Problems for PDEs II	MS-5
MSP-041	A-Posteriori Error Estimation and Adaptive Procedures in Finite Elements II	AT-5
MSP-080	Wave Field Decomposition Methods in Direct and Inverse Scattering II	AT-2B
MSP-082	Methods and Applications of Asymptotic Analysis	MS-4
MSP-088	The Dynamics of Granular Materials: Physical Modeling and Mathematical Analysis II	WRB-2
MSP-089	Some New Mathematical Developments in Atmosphere and Ocean Dynamics	DHT-S
MSP-092	Spatio-Temporal Modelling of Biological Systems: Bridging the Scale-Gap	WRB-1
MSP-097	Grid Coarsening and Multigrid Methods	DHT-B
MSP-101	Diffraction by Wedges and Related Matrix Maliuzhinets and Wiener-Hopf Systems	AT-6
MSP-104	Optimal Targeted Network Approximations of PDE Solutions II	AT-4
MSP-109	The Application of Group-Theoretic Methods to Structural Mechanics	AFB-19
MSP-110	Behavior of Solutions of Nonlinear Partial Differential Equations	WRB-4
MSP-114	Asymptotic Studies of Detonation Initiation	AT-3
MSP-126	The ECMI Special Interest Group on "Mathematics of Polymers" II	MS-1
MSP-138	Functional Approximation Methods	DHT-4.01
MSP-151	New Challenges in Control and Stabilization of Shells I	AFB-10
MSP-160	Recent Issues in Document Image Analysis and Processing	MS-3
MSP-177	Computational Image Analysis	DHT-3.01
MSP-226	Nonlinear Gravity-Capillary Free Surface Flows II	AT-2
MSP-238	Nonlinear Optimum Experimental Design: Numerical Methods and Applications in Kinetics	DHT-4.18
MSP-242	Applications of Random Dynamical Systems (RDS) II	WRB-10
MSP-253	Kinetic and Gas Dynamic Models for the Simulation of Semiconductor Devices and their Manufacturing Processes II	WRB-9
MSP-256	Mathematics in Defence	AT-8
MSP-261	Computational Electromagnetics II	DHT-N
MSP-265	Schlumberger Minisymposia Reviews II	WRB-8
	16.00 – 18.00 Contributed Presentations: Lectures	
C-1	Inverse Problems	AFB-13
C-2	Solid Mechanics, Heat Transfer and Combustion Theory	AFB-14

C-3	Computational Fluid and Solid Mechanics I	AFB-17
C-4	Numerical Linear Algebra, Optimization and Environmental Problems	AFB-18
C-29	Computer Science, Cryptography and Coding Theory	AT-2.A2

Monday, 5 July, Afternoon Session
Details

14.00 – 14.45 Plenary Lectures

Plenary Lecture — McEwan Hall

Avner FRIEDMAN (University of Minnesota, USA)

Propagation of Cracks in Elastic Media

Chair: R MENNICKEN (University of Regensburg, Germany)

The talk will describe variational principles that lead to the formulation of a crack propagation problem in elastic media under plane strain situation. The crack is assumed to propagate in a smooth fashion. It will be shown that a variational formulation, which involves the introduction of the J-integral, is equivalent to a local condition known as mode I of mode II crack. The latter formulation can be restated using an interesting relation that exists between the curvature of (any) propagating curve and the stress intensity coefficents associated with biharmonic solutions satisfying appropriate boundary conditions along the curve. Using this restatement of the problem, local existence results are proved.

Plenary Lecture — George Square Lecture Theatre

J K LENSTRA (Eindhoven University, Netherlands)

Whizzkids: Two Exercises in Computational Discrete Optimization

Chair: J C EILBECK (Heriot-Watt University, UK)

In 1996 and 1997 we organized two contests in cooperation with the software firm CMG Nederland and the newspaper De Telegraaf. The purpose of these contests was to increase interest in mathematics and computer science among highschool students. The participants had to construct a newspaper delivery scheme in 1996 and a timetable for a parents' evening in 1997. Both times they faced an optimization problem which was easy to formulate but hard to solve, and which caused exciting evenings and sleepless nights to both the puzzler at the kitchen table and the advanced algorithm designer.
I will discuss the background of the "Whizzkids contests" and describe how the tools of combinatorial optimization can be applied in finding good solution and in attempting to prove that no better solutions exist. These tools include upper bounding techniques based on local search and lower bounding techniques using linear programming and constraint satisfaction.

14.55 – 15.40 Plenary Lectures

Plenary Lecture — McEwan Hall

K MERTEN (Siemens AG, Munich, Germany)

How to Survive in Industry

Chair: R MENNICKEN (University of Regensburg, Germany)

Based on experience gained in various management positions in industry, typical problems for mathematicians in industry are discussed. The "guideline" is not complete but tries to identify typical difficulties and how to avoid them. In addition a variety of mathematical problems (in particular typical for the semiconductor industry) are presented. As a consequence some aspects or proposals for university education are discussed.

Plenary Lecture — George Square Lecture Theatre

William MORAN (Flinders University, Australia)

Sampling and Interpolation of Signals with Multi-Band Spectra

Chair: J C EILBECK (Heriot-Watt University, UK)

I will give an overview of the area of non-uniform sampling of signals with emphasis on signals whose spectra are constrained to lie in particular sets. Such problems arise in many practical situations. In particular, I will describe some recent work of Sergei Avdonin and myself aimed at finding multi-band versions of the Shannon Sampling Theorem in the following sense. We seek sampling and interpolation sequences, Λ, for signals (in L^2) with Fourier transform supported on a finite union E of disjoint intervals, $E = \bigcup_{j=1}^{N} I_j, \quad I_j = [a_j, b_j], \quad a_1 < b_1 < a_2 < b_2 < \ldots < a_N < b_N,$
The existence of such Λ for arbitrary finite union of intervals turns out to be a very difficult problem. Papers by Lyubarskii and Spikovsky and by Katsnel'son propose methods which reduce the problem to invertibility of certain types of Wiener-Hopf operators. Similar results have been obtained by us using control theory ideas.
Wiener-Hopf operators of the required form have been intensively studied, nevertheless all known methods fail to work in our general situation. I will give a general description of a novel technique, based on simple ideas from linear algebra and some results from number theory concerning uniform distribution of the fractional parts of $n\alpha$. This has allowed us to prove the invertibility of these Wiener-Hopf operators and hence to show the existence of a real sampling and interpolation sequence for the union of two arbitrary intervals with potential for generalization to arbitrary numbers of intervals. The invertibility results are also of interest for application in other problems involving Wiener-Hopf operators.

16.00 – 18.00 Mini-Symposia

MSP-012 Appleton Tower, Lecture Theatre 1

Mixing with Chaos: Fundamentals, Applications, New Directions

Organiser: KING, Gregory P (Department of Engineering, University of Warwick, UK)

The aim of this mini-symposium is to review recent advances and applications of chaos theory to transport and mixing in laminar fluid flows and the mixing of solids (granular media). Speakers will give lectures on applications in oceanography, the dynamics and transport of non-neutrally buoyant passive particles with finite size, transport of chemically and biologically active components, mixing in three-dimensional steady and unsteady flows, the mixing of mechanically identical powders. The discussion session will address the need for experimental studies and investigations of more realistic numerical models.

JONES, Christopher K R T (Brown University, USA) *Viscosity and transport in ocean models* (p. 23)
YANNACOPOULOS, Athanasios N (School of Mathematics and Statistics, University of Birmingham, UK) *Chaotic advection in biofluids* (p. 24)
TÉL, Tamás (Institute for Theoretical Physics, Eötös University, Budapest, Hungary) *Chemical or biological activity in open chaotic flows* (p. 24)
KING, Gregory P (University of Warwick, UK) *The Taylor-Couette reactor* (p. 23)
PIRO, Oreste (Mediterranean Institute of Advanced Studies (IMEDEA), CSIC-University of Balearic Islands, Spain) *Chaotic advection in three-dimensional incompressible flows* (p. 24)

MSP-014 David Hume Tower, Lecture Theatre C

Nonlinear Waves in Solids: Analytical and Numerical Aspects I

(see also Part II, MSP-015, p. 46; Part III, MSP-016, p. 64)

Organisers: MAUGIN, Gerard A (Universite Pierre Et Marie Curie, Laboratoire De Modelisation En Mecanique, Paris, France)
ENGELBRECHT, Juri (Estonian Academy of Sciences, Institute OF Cybernetics, Tallin, Estonia)
SAMSONOV, Alexander M (A I IOFFE Physico-Technical Institute, Russian Academy of Sciences, St Petersburg, Russia)

Nonlinear waves are a timely object of study. They are paradigmatic for the understanding and implementation of efficient methods of applied mathematics, as also a source of innovative methods. This minisymposium presents the latest developments which may be characterized by three general directions: (i) consideration of highly dispersive mechanisms, (ii) accounting for the presence of material inhomogeneities on the path of propagation, and (iii) quasi 1D and truly 2D systems with the allied numerical simulations. The progress achieved in recent years compared to contributions at ICIAM-91 (Washington) is clear and mostly results from fruitful co-operations within international or European programmes involving teams from the former Soviet Union, in particular within INTAS programmes

MAUGIN, Gerard A (Universite Pierre et Marie Curie, Laboratoire de Modelisation en Mecanique, Paris, France) *Soliton-complex dynamics in strongly dispersive media* (p. 27)
PASTRONE, Franco (Department of Mathematics, University of Torino, Italy) *Non-linear waves in solids with microstructures: Dissipation and amplification problems* (p. 27)
MAYER, Andreas P (Institut fuer Theoretische Physik, Universitaet Regensburg, Germany) *On the stability of surface acoustic solitary waves in coated elastic media* (p. 27)
ENGELBRECHT, Juri (Institute of Cybernetics, Estonian Academy of Sciences, Tallinn, Estonia) *Solitonic structures in KdV-based higher-order systems* (p. 25)
CHRISTIANSEN, Peter L (Department of Mathematical Modelling, Technical University of Denmark, Denmark) *Nonlinear waves in media with long range interactions* (p. 25)

MSP-020 William Robertson Building, Seminar Room 11

New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials II

(see also Part I, MSP-019, p. 13; Part III, MSP-021, p. 47; Part IV, MSP-022, p. 64; Part V, MSP-023, p. 82; Part VI, MSP-024, p. 102)

Organisers: FONSECA, Irene (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)
KINDERLEHRER, David (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)

ADAMS, Brent L (Carnegie Mellon University, Department of Materials Science & Engineering, Pittsburgh, USA) *Continuum dislocation fields at grain boundaries in deformed polycrystals: An experimental approach* (p. 31)
TA'ASAN, Shlomo (Carnegie Mellon University, Pittsburgh, USA) *Multiscale simulations of grain boundaries* (p. 35)
NOVICK-COHEN, Amy (Technion-IIT, Israel) *Wetting, prewetting, and the driving force paradox* (p. 34)
LEO, P H (University of Minnesota, USA) *The energy of semicoherent interfaces* (p. 33)
BHATTACHARYA, Kaushik (Graduate Aeronautical Laboratories, California Institute of Technology, USA) *Some thoughts on hysteresis in martensitic materials*

MSP-034 Management School, Lecture Theatre 5

Analysis of Boundary Value Problems for PDEs II

(see also Part I, MSP-033, p. 14; Part III, MSP-035, p. 47)

Organiser: KRUTITSKII, Pavel (Moscow State University, Russia)

KRUTITSKII, Pavel (Moscow State University, Russia) *Helmholtz equation in cracked domains* (p. 44)
LIFANOV, Ivan K (Airforce Engineering Academy, Russia) *Singular solutions of singular integral equations and their applications* (p. 45)
MATVEEV, Alexander F (State Science Center of Russian Federation, ITEP, Russia) *Singular integral equations with negative index: Theory, approximate solutions and applications in aerodynamics* (p. 45)
NISHIMURA, Naoshi (Department of Global Environment Engineering, Kyoto University, Japan) *A Galerkin fast multipole boundary integral equation method for elastostatic crack problems in 3D* (p. 45)

MSP-041 Appleton Tower, Lecture Theatre 5

A-Posteriori Error Estimation and Adaptive Procedures in Finite Elements II

(see also Part I, MSP-040, p. 15)

Organisers: BABUSKA, Ivo M (The University of Texas at Austin, USA)
STROUBOULIS, Theofanis (Texas A&M University, USA)

WHITEMAN, John R (Brunel University, UK) *A posteriori error estimates for quasistatic linear viscoelasticity problems* (p. 49)
STROUBOULIS, Theofanis (Dept. of Aerospace Engineering, Texas A&M University, USA) *A-posteriori estimation and adaptive control of the error in the quantity of interest in the FEM and GFEM* (p. 49)
PERAIRE, Jaime (Dept. of Aeronautics and Astronautics, Massachusetts Institute of Technology, USA) *Adaptive bound computations for functional outputs of partial differential equations* (p. 49)

MSP-080 Appleton Tower, Room 2B

Wave Field Decomposition Methods in Direct and Inverse Scattering II

(see also Part I, MSP-079, p. 16; Part III, MSP-081, p. 50)

Organisers: KARLSSON, Anders (Department of Electromagnetic Theory, Lund Institute of Technology, Sweden)
FISHMAN, Louis (Naval Research Laboratory, USA)

MSP-082 Management School, Lecture Theatre 4

Methods and Applications of Asymptotic Analysis

Organisers: TEMME, Nico M (C W I, Amsterdam, The Netherlands)
OLDE DAALHUIS, Adri B (Department of Mathematics, University of Edinburgh, UK)

Asymptotic analysis is an important tool in many branches of mathematics, physics and other application areas. When solving problems described in terms of differential equations or integrals, it is often required to obtain qualitative information on the solution of the problem. Another area of interest is the study of the behaviour of certain special functions for large values of one or several (complex) parameters and the application of uniform asymptotic expansions in computing special functions for a large domain of the parameters. This mini-symposium presents several actual problems in which asymptotics plays an important role.

MSP-088 William Robertson Building, Seminar Room 2

The Dynamics of Granular Materials: Physical Modeling and Mathematical Analysis II

(see also Part I, MSP-087, p. 17)

Organisers: PITMAN, E Bruce (Dept of Mathematics, State University of New York, Buffalo, USA)
SHEARER, Michael (Dept of Mathematics, North Carolina State University, Raleigh, USA)

MSP-089 David Hume Tower, Faculty Room South

Some New Mathematical Developments in Atmosphere and Ocean Dynamics

Organiser: ROULSTONE, Ian (Meteorological Office, UK)

Atmospheric cyclones and anticyclones represent the rotating coherent structures that correspond to vortices in a fluid in which there is a balance between the Coriolis, buoyancy and pressure-gradient forces. A precise mathematical description of these vortex structures is crucial for weather forecasts. They have been studied, both analytically and numerically, using approximations to Newtonian dynamics. Several models exist; some have recently been shown to be hamiltonian, which makes them amenable to solution. We will discuss some new results on integrability, turbulence, and regularity of solutions of such models, which will interest researchers in mathematical physics and fluid mechanics.

HOLM, Darryl D (Los Alamos National Laboratory, USA) *The Euler-Poincaré theorem, integrable PDE's and a new closure model for turbulent channel flow* (p. 90)
LEITH, Cecil E (Isaac Newton Institute, Cambridge, UK) *Shallow water turbulence* (p. 90)
MAHALOV, Alex M (Arizona State University, USA) *Fast singular oscillating limits of stably stratified three-dimensional Euler-Boussinesq equations* (p. 90)
MORRISON, Philip J (University of Texas at Austin, USA) *An integral transform for shear flow* (p. 90)
TITI, Edriss S (University of California, Irvine, USA) *On the connection between the Camassa-Holm equations and turbulence theory* (p. 91)

MSP-092 William Robertson Building, Seminar Room 1

Spatio-Temporal Modelling of Biological Systems: Bridging the Scale-Gap

Organiser: GIBSON, Gavin J (Biomathematics and Statistics Scotland, Edinburgh, UK)

Models of spatially-extended systems are frequently formulated in terms local interactions (e.g. infectious contacts in a population), with the aim of understanding behaviour at larger scales. Techniques to enable this scale transition include numerical integration, stochastic analysis and approximation methods. While these have proved useful, new approaches (e.g. to predict and characterise large-scale spatial heterogeneity) are needed. The mini-symposium will illustrate the problem of scaling-up using biological/epidemiological systems and will describe and illustrate new mathematical approaches, both stochastic and deterministic. It is intended to attract all with an interest in the theory or application of spatio-temporal methods.

GILLIGAN, Christopher A (University of Cambridge, UK) *Modelling dynamics of fungal diseases in plant populations: scaling up from fungal colonies to regions* (p. 93)
SHERRATT, Jonathan A (Dept of Mathematics, Heriot-Watt University, Edinburgh, UK) *Microscopic vs macroscopic mathematical models for spatiotemporal dynamics during wound healing* (p. 93)
HAMBLY, Ben M (University of Edinburgh, UK) *Martingales in the study of the contact distribution in plant epidemics* (p. 93)
MARION, Glenn (University of Strathclyde, Glasgow, UK) *Scaling behaviour in spatial-temporal models for two species reactions* (p. 93)
VAN DEN BOSCH, Frank (Wageningen Agricultural University, The Netherlands) *Pattern formation in spider mite - predatory mite systems* (p. 93)

MSP-097 David Hume Tower, Lecture Theatre B

Grid Coarsening and Multigrid Methods

Organiser: DOUGLAS, Craig C (University of Kentucky, USA)

Simulations on large, highly unstructured grids are now commonplace. The inner linear systems that arise have led to great interest in grid coarsening methods, algebraic multigrid, and cache aware variants of algorithms used in the solvers. This minisymposium will cover current lines of research: how to coarsen grids in a manner that makes sense to the underlying problem, how to design algorithms independent of the computer architecture and ones that scale well on parallel computers, and how to re-order algorithms to take advantage of the memory hierarchies that all high performance RISC based computers have.

SAUTER, Stefan (Universitaet Leipzig, Germany) *Composite finite elements for problems with jumping coefficients* (p. 99)
RUGE, John (Front Range Scientific Computations, Inc., USA) *Algebraic multigrid methods for the solution of PDE's: Old and new ideas* (p. 98)
HENSON, Van Emden (Lawrence Livermore National Laboratory, USA) *Advances in parallelizing algebraic multigrid* (p. 98)
DOUGLAS, Craig C (University of Kentucky, USA) *Cache based multigrid methods for problems on unstructured grids* (p. 98)

MSP-101 Appleton Tower, Seminar Room 6
Diffraction by Wedges and Related Matrix Maliuzhinets and Wiener-Hopf Systems

Organisers: ABRAHAMS, I David (University of Manchester, UK)
LAWRIE, Jane B (Brunel University, UK)

This mini-symposium aims to focus on recent mathematical developments in the solution of matrix Wiener-Hopf equations and scalar and matrix functional difference equations of Maliuzhinets' type. The latter arise naturally in problems with wedge-shaped geometries after application of a Sommerfeld integral transform, and the former occur in a very wide range of boundary value problems in engineering and mathematical physics. The two methods can be shown to be, in some sense, equivalent, and both involve construction of functions (referred to as the Wiener-Hopf kernel and Maliuzhinets' function respectively) which are free of singularities in a complex plane. Although the above analytical approaches are successful for scalar equations, they do not easily carry over to matrix systems or other complicated cases (such as to wedge diffraction with high-order face conditions). Recent years have seen very significant progress on extending both methods to solving systems of equations arising from physical applications in areas such as diffraction theory, elastodynamics, fracture mechanics, fluid flow, structural acoustics etc. The range of talks are given by researchers from Russia, Europe and the USA and this minisymposium aims to summarize the major advances, both analytical and numerical, which have been made in this field in recent years.

OSIPOV, Andrey V (St Petersburg State University, Russia) *New algorithms for the computation of Malyuzhinets' special function* (p. 101)
BUDAEV, Bair V (University of California at Berkely, USA) *What is wrong with the Maliuzhinets function?* (p. 101)
NORRIS, Andrew N (Rutgers University, USA) *Wiener-Hopf problems associated with thin plate diffraction* (p. 101)
LYALINOV, Michael A (Dept. Mathem. Physics, St Petersburg University, Russia) *Coupled Maliuzhinets' equations and their direct reduction to Fredholm type integral equations* (p. 101)
LAWRIE, Jane B (Brunel University, UK) *On the diffraction of waves in wedges with contrasting material properties* (p. 101)

MSP-104 Appleton Tower, Lecture Theatre 4
Optimal Targeted Network Approximations of PDE Solutions II
(see also Part I, MSP-103, p. 18)

Organisers: INGERMAN, David (Courant Institute of Mathematical Sciences, USA)
DRUSKIN, Vladimir (Schlumberger-Doll Research, USA)

INGERMAN, David (Courant Institute of Mathematical Sciences, USA) *Characterizations and approximations of planar Dirichlet-to-Neumann maps* (p. 103)
MOSKOW, Shari (University of Florida, USA) *Three point finite difference schemes and the spectral Galerkin method* (p. 103)
KNIZHNERMAN, Leonid (Central Geophysical Expedition, Russia) *Optimal network approximation for large spectral intervals* (p. 103)

MSP-109 Adam Ferguson Building, Room 19
The Application of Group-Theoretic Methods to Structural Mechanics

Organiser: GUEST, Simon D (Department of Engineering, University of Cambridge, UK)

The application of symmetry arguments to the understanding of the mechanics of macroscopic structures is still a novelty. However, a number of recent advances have shown the powerful insights that can be gained from the application of symmetry arguments. These advances include a symmetry extension of Maxwell's rule for the rigidity of frames, an understanding of finite mechanisms in symmetric structures, the generation of tensegrities, and group-theoretic approaches to bifurcation analysis. This mini-symposium aims to bring together workers in diverse areas to identify interesting problems in the mechanics of structures where a group-theoretic approach can give new insight.

CONNELLY, Robert (Cornell University, USA) *Cataloging stable symmetric tensegrity structures* (p. 108)
GUEST, Simon D (Department of Engineering, University of Cambridge, UK) *A symmetry viewpoint of structural mechanics* (p. 108)
BOSSAVIT, Alain (Électricité de France, France) *What do we mean by "The symmetries of an equation"?* (p. 107)

MSP-110 William Robertson Building, Seminar Room 4
Behavior of Solutions of Nonlinear Partial Differential Equations

Organisers: TSUTSUMI, Masayoshi (Dept of Applied Physics, Waseda University, Japan)
FUKUDA, Isamu (Dept of Architecture, Kokushikan University, Japan)

Many problems appearing in industry and science call for nonlinear partial differential equations. Recently, the number of models which are described by nonlinear partial differential equations has increased. In this mini-symposium, we introduce some nonlinear models and investigate the behavior of solutions for such problems. Topics which will be talked about are blow-up and global existence of solutions of degenerate parabolic equations, blow-up of solutions of semilinear parabolic equations with localized reaction, weak solutions of semilinear equations in a Hilbert space and so on.

FUKUDA, Isamu (Dept. of Architecture, Kokushikan University, Japan) *Blow-up of solutions of semilinear parabolic equations with localized reactions* (p. 108)
IDOGAWA, Tomoyuki (Dept. of Electronic & Information Systems, Shibaura Inst. of Tech., Japan) *On the projection to a certain convex set in $H_0^1(\Omega)$* (p. 108)
KOJO, Tomomi (Dept. of Machinery & Control Systems, Shibaura Inst. of Tech., Japan) *Weak solutions for some nonlinear differential equations in a Hilbert space* (p. 108)
SUZUKI, Ryuichi (Dept. of Mechanical Engineering, Kokushikan University, Japan) *Existence and nonexistence of local or global solutions of quasilinear degenerate parabolic equations* (p. 109)
TSUTSUMI, Masayoshi (Dept. of Applied Physics, Waseda University, Japan) *Penalty method for variational inequalities and its error estimates* (p. 109)

MSP-114 Appleton Tower, Lecture Theatre 3
Asymptotic Studies of Detonation Initiation

Organisers: DOLD, John W (UMIST, UK)
KAPILA, Ashwani K (Rennselaer Polytechnic Institute, USA)

Assuming highly state-sensitive chemistry, asymptotic investigations are proving valuable in interpreting numerical studies of the way in which a reacting compressible medium can ignite to produce a detonation. The presence of weak and strong waves of reactivity is found, with transition between the two. Waves can also appear as more benign, subsonic, deflagrations. A key question is the nature of conditions that become susceptible to transforming a deflagration into a detonation. Drag or momentum loss in a medium are one way of achieving this. The work relates to questions of safety as well as numerical and experimental issues.

DOLD, John W (UMIST, UK) *Emergence of a weak detonation in compressible self-ignition* (p. 111)
KAPILA, Ashwani K (Rensselaer Polytechnic Institute, USA) *Rapid transition: From weak detonation to Chapman-Jouguet structure* (p. 111)
SHORT, Mark (Theoretical and Applied Mechanics, University of Illinois, USA) *Detonation initiation by slowly-varying initial flow non-uniformities* (p. 112)
BOOTY, Michael (New Jersey Institute of Technology, USA) *Time-dependent fast deflagration waves* (p. 111)

MSP-126 Management School, Lecture Theatre 1

The ECMI Special Interest Group on "Mathematics of Polymers" II

(see also Part I, MSP-125, p. 19)

Organiser: CAPASSO, Vincenzo (Dept of Mathematics, University of Milan, Italy)

SALANI, Claudia (Department of Mathematics, Milano, Italy) *Interaction of the crystallization process of Polymers with temperature field* (p. 122)
ALFONSO, Giovanni C (Department of Chemistry and Industrial Chemistry, University of Genova, Italy) *Molecular weight effect on crystal nucleation in sheared polymer melts* (p. 121)
MICHELETTI, Alessandra (MIRIAM, Dept. Of Mathemamatics, University of Milan, Italy) *Boolean models and spatial statistics applied to the modelling of polymer crystallization* (p. 122)
VAN DE VEN, Alfons A F (Eindhoven University of Technology, The Netherlands) *Morphology of polymer blends* (p. 123)
BONILLA, Luis L (Escuela Politecnica Superior, Universidad Carlos III Madrid, Spain) *Kinetic theory of aggregation and growth in polimers* (p. 121)

MSP-138 David Hume Tower, Room 4.01

Functional Approximation Methods

Organisers: ROUFF, Marc (LGEP-ESE-Plateau du Moulon, France)
COTSAFTIS, Michel (LTME-ECE, Paris, France)

This session is intended to give three approaches for representing the solutions of differential equations of physical and/or technical systems. The first one tries to give the best possible basis of representation by using functions of low degree distributed over the interval. The second one uses self constructing nonlinear respresentation function over the complete interval. The last one proposes the construction of a representation directly from the analysis of the equations with constraint of covering the power flow to a certain order of approximation.

ROUFF, Marc (Laboratoire de Génie Electrique de Paris, ESE, France) *The analytical computation of C^k spline spectra* (p. 131)
MURATA, Junichi (Kyushu University, Japan) *Neural network structure design using genetic algorithm* (p. 131)
COTSAFTIS, Michel (LTME/ECE, France) *Exact vs asymptotic representation of solution of dynamical equations* (p. 130)
VILJAMAA, Pauli (Tampere University of Technology, Finland) *Basis functions in soft computing* (p. 131)

MSP-151 Adam Ferguson Building, Room 10

New Challenges in Control and Stabilization of Shells I

(see also Part II, MSP-152, p. 51)

Organisers: DELFOUR, Michel C (Centre de Recherches Matheématiques, Canada)
ZOLÉSIO, Jean-Paul (Ecole des Mines de Paris and CNRS, France)

Plates, shells and structures are examples of systems where the geometry plays an active part is the control and stabilizing properties of the system. The geometry becomes very critical as the structure becomes very thin and its design cannot be dissociated from the choice of the control law. The study of the control of thin and asymptotic shells has revealed new phenomena and shown the intricate interplay between the control and the design (geometry) of such systems.

BRADLEY, Mary E (University of Louisville, USA) *Bilinear optimal control of a Kirchhoff plate via velocity controller* (p. 142)
HORN, Mary Ann (Vanderbilt University, USA) *Boundary controllability for coupled elastic systems* (p. 142)
LAGNESE, John E (Georgetown University, USA) *Domain decomposition in exact controllability* (p. 143)
LASIECKA, Irena (University of Virginia, USA) *Control and design of structural acoustic models with themoelastic effects* (p. 143)
SCHMIDT, Georg (McGill University, Canada) *On the controllability of vibrating mechanical structures from one equilibrium location to another* (p. 143)

MSP-160 Management School, Lecture Theatre 3
Recent Issues in Document Image Analysis and Processing

Organisers: COSSU, Rossella (Istituto per le Applicazioni del Calcolo-CNR, Roma, Italy)
CINQUE, Luigi (Dipartimento Di Scienze Dell'Informazione, Universita' "La Sapienza", Roma, Italy)

Document image analysis is the research key area that allows the contents of documents on paper to be codified into electronic form. The presentations will regard new important research lines as multiresolution and syntax analysis, an investigation about the use of CASE tools to prototyping and maintaining software systems specifically devoted to document treatment and applications focused on information recovering of ancient documents. Since Italy possesses the greatest heritage of paper documents and book material present in the world, the document image analysis can give a contribute to analyze and preserve the paper heritage testifying to our past events.

LEVIALDI, Stefano (Dipartimento Di Scienze Dell'Informazione, Universita' "La Sapienza" Roma, Italy) *Visualizing documents and their features* (p. 149)
LOMBARDI, Luca (Dipartimento Di Informatica e Sistemistica, Universita' Pavia, Italy) *Segmenting documents by a multiresolution approach* (p. 150)
COSSU, Rossella (Istituto per le Applicazioni del Calcolo-CNR, Roma, Italy) *Document analysis experience in ancient books* (p. 149)
CINQUE, Luigi (Dipartimento Di Scienze Dell'Informazione, Universita' "La Sapienza" Roma, Italy) *Segmentation of page images having artifacts of photocopying and scanning* (p. 149)
IMPEDOVO, Sebastiano (Consorzio Interuniversitario Nazionale per l'Informatica (CINI), Università di Bari, Italy) *Document analysis systems: State of the art and future trends* (p. 149)

MSP-177 David Hume Tower, Room 3.01
Computational Image Analysis

Organisers: SGALLARI, Fiorella (Dipartimento di Matematica, Universita' di Bologna, Italy)
REICHEL, Lothar (Department of Mathematics and Computer Science, Kent State University, USA)

The purpose of image processing is to facilitate the analysis and extraction of information from images that may be degraded by noise and blur. Available images may have to be restored or segmented before information can be extracted. Applications can be found in many areas, including medical diagnosis and satellite surveillance. Since the number of pixels often exceeds several hundred thousands even for 2-D images of moderate resolution, image processing involves many computationally intensive tasks. Often it is desirable that these tasks be carried out in real-time. It is the purpose of this minisymposium to present an overview of recent developments in methods for image processing and analysis. This minisymposium will be of interest to researchers and engineers who develop or apply image processing and analysis methods, as well as to numerical analysts and applied mathematicians interested in large-scale real-time computational problems.

CALVETTI, Daniela (Case Western Reserve University, USA) *Expansion methods in image restoration* (p. 164)
CHAN, Tony F (University of California at Los Angeles, USA) *Nonlinear PDE models in image processing* (p. 164)
SETHIAN, James A (University of California at Berkeley, USA) *Application of fast marching and level set methods to image processings and computer vision* (p. 165)
MIKULA, Karol (Slovak University of Technology, Slovakia) *Nonlinear multiscale analysis of 3D image sequences* (p. 165)

MSP-226 Appleton Tower, Lecture Theatre 2
Nonlinear Gravity-Capillary Free Surface Flows II
(see also Part I, MSP-168, p. 20)

Organiser: VANDEN-BROECK, Jean-Marc (University of East Anglia, UK)

KING, Andrew C (School of Mathematics and Statistics, University of Birmingham, UK) *The formation and motion of a three phase contact line in a viscous fluid* (p. 157)
HOWISON, Sam (OCIAM, Mathematical Institute, Oxford University, UK) *Stokes flow with free surfaces* (p. 156)
VANDEN-BROECK, Jean-Marc (University of East Anglia, School of Mathematics, UK) *Ripples on gravity-capillary free surface flows* (p. 157)

MSP-238 David Hume Tower, Room 4.18

Nonlinear Optimum Experimental Design: Numerical Methods and Applications in Kinetics

Organisers: SCHLÖDER, Johannes P (Interdisciplinary Center for Scientific Computing (IWR), Germany)
BOCK, H Georg (Interdisciplinary Center for Scientific Computing (IWR), Germany)

Optimum experimental design for parameter estimation in models described by nonlinear differential algebraic equations results in intricate nonlinear optimal control problems. They are subject to control and state constraints and typically have an objective function implicitly defined by the sensitivities of the parameter estimation problem. The minisymposium addresses features of these problems and describes direct methods for their numerical treatment. Numerical results including industrial applications in chemical reaction kinetics and biotechnology are presented. They show that the new model based approach results in a drastic reduction of experimental effort and significantly improves the statistical quality of the estimated parameters.

BAUER, Irene (Interdisciplinary Center for Scientific Computing, Germany) *Numerical methods for optimum experimental design in DAE systems* (p. 208)
KUD, Alexander (BASF Aktiengesellschaft, Germany) *Sequential experimental design in reaction kinetics* (p. 208)
ESTLER, Manfred (Degussa AG, Hanau-Wolfgang, Germany) *Optimal experimental design for the parameter identification of enzyme catalytic processes* (p. 208)
HAARIO, Heikki (University of Helsinki, Finland) *Global criteria for optimal design* (p. 208)

MSP-242 William Robertson Building, Seminar Room 10

Applications of Random Dynamical Systems (RDS) II

(see also Part I, MSP-011, p. 12)

Organisers: NAMACHCHIVAYA, N Sri (University of Illinois, Urbana-Champaign, USA)
SOWERS, Richard (University of Illinois, Urbana-Champaign, USA)

FREIDLIN, Mark (Univeristy of Maryland, USA) *Stochastic behaviour of perturbed Hamiltonian systems* (p. 22)
WEDIG, Walter V (Institut für Technische Mechanik, Universität Karlsruhe, Germany) *Stationary solutions of higher-dimensional Fokker-Planck equations* (p. 23)
SOWERS, Richard (University of Illinois, Urbana-Champaign, USA) *Stochastic dynamical systems: Asymptotic and averaging* (p. 23)

MSP-253 William Robertson Building, Seminar Room 9

Kinetic and Gas Dynamic Models for the Simulation of Semiconductor Devices and their Manufacturing Processes II

(see also Part I, MSP-057, p. 15)

Organiser: RINGHOFER, Christian (Arizona State University, USA)

LEVERMORE, C David (University of Arizona, USA) *The zero dispersion limit of the NLS/mKdV hierarchy for the Nonselfadjoint Zakharov-Shabat operator* (p. 62)
MUSCATO, Orazio (Dipartimento di Matematica, Catania, Italy) *Check of the consistency of carrier transport models in semiconductor devices with the Onsager reciprocity principle* (p. 62)

MSP-256 Appleton Tower, Seminar Room 8

Mathematics in Defence

Organisers: DE NEUMANN, Bernard (DERA, UK)
MCWHIRTER, John G (DERA, UK)

Mathematics is an important discipline in the defence field, and this minisymposium will illustrate some of the problems attacked, and the types of mathematics used. This is a highly dynamic area with potential applications arising continuously as technology and societal constraints advance and change directions. The problems faced generally involve the interaction of complex systems, and are often such as to preclude experimentation, and so their solutions depend strongly upon mathematical modelling skills.

MSP-261
Computational Electromagnetics II

David Hume Tower, Faculty Room North

(see also Part I, MSP-260, p. 22)

Organisers: MORGAN, Kenneth (University of Wales, Swansea, UK)
MCCOWEN, Andy (University of Wales, Swansea, UK)

MSP-265
Schlumberger Minisymposia Reviews II

William Robertson Building, Lecture Theatre 8

(see also Part I, MSP-264, p. 22)

Organisers: BURRIDGE, Robert (Schlumberger-Doll Research, USA)
COVENEY, Peter V (Department of Chemistry, Queen Mary & Westfield College, University of London, UK)

16.00 – 18.00 Contributed Presentations: Lectures

C-1 Adam Ferguson Building, Room 13
Inverse Problems
Chair(s): COLLINS; TUCK

16.00–16.15 HOFMANN, Bernd (Faculty of Mathematics, Technical University of Chemnitz, Germany) *Stability rates for ill-posed problems with compact and noncompact operators* (p. 270)
16.15–16.30 BARONE, Piero (Istituto per le Applicazioni del Calcolo, CNR, Italy) *The numerical inversion of the Laplace transform to solve the nuclear magnetic resonance relaxometry problem* (p. 240)
16.30–16.45 COLLINS, Derek (University of Sheffield, UK) *Calculating contact pressures from strain and deflection data* (p. 249)
16.45–17.00 SÁNCHEZ-ÁVILA, Carmen (Dpto. Matemática Aplicada. ETSI Telecomunicación. UPM, Madrid, Spain) *Sharp edge signal deconvolution by wavelets* (p. 306)
17.00–17.15 HA-DUONG, Tuong (Universite de Technologie de Compiegne, France) *On the inverse source problem from boundary measurements* (p. 267)
17.15–17.30 HETTLICH, Frank (Institut für Angewandte Mathematik, Universität Erlangen-Nürnberg, Germany) *On an inverse obstacle problem for the heat equation* (p. 270)
17.30–17.45 TUCK, Ernest O (University of Adelaide, Australia) *Inversion of a generalised Hilbert transform* (p. 318)
17.45–18.00 SHIROTA, Kenji (Department of Mathematical Sciences, Ibaraki University, Japan) *Inverse boundary value problem with the unknown material* (p. 310)

C-2 Adam Ferguson Building, Room 14
Solid Mechanics, Heat Transfer and Combustion Theory
Chair(s): PITTERI; CALDWELL

16.00–16.15 OLEAGA, Gerardo E (Universidad Complutense de Madrid, Spain) *An explicit solution in plane elasticity* (p. 294)
16.15–16.30 SCHMIDT, Martin O (Institute for Strength of Materials, Graz University of Technology, Austria) *On the calculation of plastic spin in a model of crystal plasticity based on symmetric tensors* (p. 307)
16.30–16.45 PITTERI, Mario (DMMMSA-University of Padova, Italy) *Non-generic concentrations in shape-memory alloys; the case of Cuznal* (p. 298)
16.45–17.00 ARIPOV, Mirsaid (Tashkent State University, Tashkent, Uzbekistan) *One splitting method for some class of the quasilinear equations* (p. 237)
17.00–17.15 VOLPERT, Vladimir A (Northwestern University, USA) *Mathematical modelling of frontal polymerization* (p. 324)
17.15–17.30 KORZEŃ, Manfred (Bundesanstalt fuer Materialforschung -und pruefung (BAM), Fire Engineering, Berlin, Germany) *Fast data assimilation in fire tests of steel members* (p. 279)
17.30–17.45 CALDWELL, James (City University of Hong Kong, Hong Kong, China) *Spherical solidification by enthalpy method and heat balance integral method* (p. 245)
17.45–18.00 CUMMINGS, Linda J (Ecole Normale Superieure, France) *Convection-dominated heat transfer in closed-streamline fluid flows* (p. 251)

C-3 Adam Ferguson Building, Room 17

Computational Fluid and Solid Mechanics I

Chair(s): SCHÄFER; HEIL

16.00–16.15 NIESSNER, Herbert (Independent, Baden-Rütihof, Switzerland) *Calculation of one-dimensional unsteady flow in pipes with large cross-section variations by the method of Lax-Wendroff with modified flux-correction* (p. 293)
16.15–16.30 GERVASIO, Paola (Department of Electronics for Automation, University of Brescia, Italy) *Homogeneous and heterogeneous coupling for 2D viscous incompressible flows via domain decomposition methods* (p. 263)
16.30–16.45 SCHÄFER, Michael (Department of Mechanical Engineering, Darmstadt University of Technology, Germany) *Numerical simulation of fluid-structure interaction for fluid damped oscillations* (p. 307)
16.45–17.00 BODNÁR, Tomáš (Czech Technical University, Prague, Czech Republic) *Numerical simulation of flow and pollution dispersion in 3d atmospheric boundary layer* (p. 242)
17.00–17.15 RIMBEY, Scott E (Educational Testing Service, USA) *Transonic axisymmetric nozzle flows* (p. 303)
17.15–17.30 SIEGL-MAITZ, Annemarie (Institute for Strength of Materials; Graz University of Technology) *An adaptive finite element procedure for planar elastic problems using wavelets* (p. 311)
17.30–17.45 HEIL, Matthias (Department of Mathematics, University of Manchester, UK) *Airway closure - liquid bridges in strongly buckled elastic tubes* (p. 269)
17.45–18.00 VERMA, Anjulika (School of Mathematics and Computing, University of Brighton, Brighton, UK) *Modelling of an explosion bubble close to a moving structure* (p. 322)

C-4 Adam Ferguson Building, Room 18

Numerical Linear Algebra, Optimization and Environmental Problems

Chair(s): HACKBUSCH; SMITH

16.00–16.15 GRUND, Friedrich (Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany) *Pivot strategies for direct linear solvers* (p. 265)
16.15–16.30 GARCIA-PALOMARES, Ubaldo M (Universidad Simon Bolivar, Venezuela) *Parallel conjugate gradient for solving algebraic linear system of equations* (p. 261)
16.30–16.45 HACKBUSCH, Wolfgang (University of Kiel, Germany) *Fast arithmetic with hierarchical matrices* (p. 267)
16.45–17.00 SCHWETLICK, Hubert (Technical University of Dresden, Dresden, Germany) *A generalized Rayleigh quotient iteration for approximating Eigenpairs of nonnormal matrices* (p. 307)
17.00–17.15 MIJANGOS, Eugenio (Basque Country University, Spain) *Multiplier methods for nonlinear networks with side constraints* (p. 288)
17.15–17.30 LIN, Feng Lee (Department of Business Management, National Sun Yat-Sen University, Taiwan) *Modeling a reliability location problem by Taguchi's approach* (p. 284)
17.30–17.45 SMITH, Ronald (Loughborough University, UK) *Cooperative pollution minimization for two outfalls in an estuary* (p. 312)
17.45–18.00 FAGHLOUMI, Chakib (Dpto. de Matemática Aplicada, Univ. Complutense de Madrid, Spain) *Analysis of nonlinear elliptic problem arising in the study of policies on projects alterning the environment* (p. 258)

C-29 Appleton Tower, Room 2.A2

Computer Science, Cryptography and Coding Theory

Chair(s): KILPATRICK

16.00–16.15 LI, Qian (Yamagata University, Japan) *A factoring algorithm using quadratic residue* (p. 283)
16.15–16.30 CABALLERO-GIL, Pino (University of La Laguna, Spain) *Algorithm-independent attacks on unkeyed hash functions and digital signature schemes* (p. 245)
16.30–16.45 KILPATRICK, Peter L (The Queen's University of Belfast, UK) *Specification of a complex scientific domain using a formal notation* (p. 277)
16.45–17.00 CLINT, Maurice (Queen's University of Belfast, N Ireland, UK) *Re-engineering sequential mathematical library software for efficient parallel execution* (p. 249)
17.00–17.15 ABELLO, James (Shannon Laboratory, AT&T Labs-Research, USA) *Navigating graph surfaces* (p. 234)
17.15–17.30 No talk
17.30–17.45 No talk
17.45–18.00 No talk

ICIAM 99
5 - 9 July 1999

Tuesday, 6 July, Morning Session
Overview

	09.00 – 09.45 Plenary Lectures	
	S Jonathan CHAPMAN, *Macroscopic Models of Superconductivity*	GS
	L GREENGARD, *On the Numerical Solution of Partial Differential Equation in Unbounded Domains*	MH
	09.55 – 10.40 Plenary Lectures	
	C JOHNSON, *Adaptive Computational Methods for Differential Equations*	MH
	E G VIRGA, *Exotic Applications of Liquid Crystals*	GS
	11.00 – 13.00 Mini-Symposia	
MSP-003	Resource Allocation	DHT-4.18
MSP-004	Kinetic Equations in Semiconductor Modelling	WRB-9
MSP-005	The Role of Non-Hydrostaticity in Climate Dynamics of the Atmosphere, Ocean and Ice Sheets	DHT-S
MSP-007	Applications of Knot Theory in Dynamics and Fluid Mechanics	WRB-10
MSP-008	Finite Element Models in Low Frequency Electromagnetics	DHT-N
MSP-009	Pseudospectra: Theory and Applications	MS-3
MSP-015	Nonlinear Waves in Solids: Analytical and Numerical Aspects II	DHT-C
MSP-018	Inverse Problems in Imaging	MS-1
MSP-021	New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials III	WRB-11
MSP-026	Statistical Theories of Vorticity Structures in Navier-Stokes Turbulence	AT-1
MSP-035	Analysis of Boundary Value Problems for PDEs III	DHT-3.01
MSP-036	Numerical Modelling with Functional Differential Equations I	AFB-19
MSP-042	Industrial Applications of Particle Methods for Fluid and Granular Flow	AT-8
MSP-044	Mathematical Modelling and Prediction of Protein Structures	WRB-1
MSP-045	Computational Science and Engineering: How to Organize? How to Teach?	GS
MSP-050	Hysteresis, Sweeping Processes and the Skorokhod Problem I	AT-6
MSP-076	Domain Decomposition Methods and Computation Mechanics I	DHT-B
MSP-081	Wave Field Decomposition Methods in Direct and Inverse Scattering III	AT-2B
MSP-094	HP and Spectral Methods for Composite Materials	AT-5
MSP-111	Degenerate Diffusion Equations I	WRB-4
MSP-139	Magnetohydrodynamics: MHD in Materials Processing, MHD Turbulence, Modelling of MHD Processes I	AT-2
MSP-152	New Challenges in Control and Stabilization of Shells II	AFB-10
MSP-183	Ignition and Flame Propagation in Multiphase Media	AT-3
MSP-197	Advanced Numerical Computing: Grid Generation and Solution Methods for Complex Applications I	MS-5
MSP-212	Industrial Research Successes	MS-4
MSP-228	Numerical Methods for Tracking Material Interfaces	AT-4
MSP-232	Risk Management	WRB-8
MSP-240	Parallel Solution Methods in Structural Analysis	DHT-4.01
	11.00 – 13.00 Contributed Presentations: Lectures	
C-5	Partial Differential Equations I	AFB-13
C-6	Ordinary Differential Equations	AFB-14
C-7	Applied Probability and Statistics I	AFB-17

C-23	Fluid Mechanics I	AFB-18
C-30	Numerical Methods in Differential Equations I	AT-2.A2
C-37	Geophysical Sciences and Computational Fluid Mechanics	WRB-3
C-41	Electromagnetics and Geophysics	AT-2D
C-51	Mathematical Methods and Modelling	DHT-3.18
	11.00 – 13.00 Contributed Presentations: Posters	
P-1	Posters I	DHT-LF

	Also today	
09.45	**1999 Dalquist Prize presentation**, see p. 223	McEwan Hall
	Financial Mathematics Special Interest day, see p. 222	

Tuesday, 6 July, Morning Session
Details

09.00 – 09.45 Plenary Lectures

Plenary Lecture — George Square Lecture Theatre

S Jonathan CHAPMAN (University of Oxford, UK)

Macroscopic Models of Superconductivity

Chair: R M MATTHEIJ (Technische Universiteit, Eindhoven, Netherlands)

One of the interesting aspects of superconductivity is the variety of models available to describe the phenomenon at different lengthscales, ranging from the microscopic theory of Bardeen, Cooper & Schreiffer through the mesoscopic theories of London and Ginzburg & Landau, to the macroscopic Critical State theories such as the Bean model. Determining the relationship between these different models by considering suitable asymptotic limits has been one of the main themes of the speakers research in the area.
The basic building block in deriving this heirarchy is the superconducting vortex, which is a thin core of nonsuperconducting material circled by a superconducting electric current. Similar line singularities are found in other systems, for example, line vortices in an inviscid fluid, or Volterra dislocations in an elastic crystal. This raises the interesting question of whether analogous heirarchies of models exist in each of these other systems, and whether similar connections can be established between them.

Plenary Lecture — McEwan Hall

L GREENGARD (Courant Institute for Mathematical Science, New York, USA)

On the Numerical Solution of Partial Differential Equation in Unbounded Domains

Chair: L N TREFETHEN (Oxford University, UK)

Many problems in applied mathematics require the solution of partial differential equations in unbounded domains. Integral equation methods are particularly appropriate for such problems since they are insensitive to the complexity of the geometry and do not require the artificial truncation of the computational domain, as do finite difference and finite element techniques. We present recent developments in potential theory which result in fast algorithms for the Helmholtz, heat and wave equations.

09.55 – 10.40 Plenary Lectures

Plenary Lecture — McEwan Hall

C JOHNSON (Chalmers University of Technology, Göteborg, Sweden)

Adaptive Computational Methods for Differential Equations

Chair: L N TREFETHEN (Oxford University, UK)

We give an overview of our recent work together with coworkers including Rickard Bergstrom, Kenneth Eriksson, Niklas Eriksson, Johan Hoffman, Mats Larson, Anders Logg, Marten Levenstam and Klas Samuelsson. We present a general methodology for adaptive quantitative control of the computational error in solving differential equations including errors from discretization in space-time, approximate solution of the discretized equations, and various modeling errors. The error control uses an adaptive feed-back procedure based on representing the error in a given norm in terms of different residuals of the computed solution and the computed solution of an associated dual linearized problem.
We present different implementations of the general methodology including a multi-adaptive ode-solver with the time steps for different components controled individually, and applications to electromagnetics and fluid/solid mechanics in 3 space dimensions. See http://www.md.chalmers.se/Centres/Phi .

Plenary Lecture — George Square Lecture Theatre

E G VIRGA (University of Pavia, Italy)

Exotic Applications of Liquid Crystals

Chair: R M MATTHEIJ (Technische Universiteit, Eindhoven, Netherlands)

This lecture will review both old and new applications of liquid crystals relevant to the mathematical modelling of these fascinating mesophases. I intend to cover a wide spectrum spanning from the optical properties of nematic liquid crystals currently employed in displays to the dynamics of lyotropic phases such as lipid bilayers, which seem to be nearly ubiquitous in living organisms.

11.00 – 13.00 Mini-Symposia

MSP-003
Resource Allocation

David Hume Tower, Room 4.18

Organiser: MILLS, Graham (CSIRO, Australia)

Exact and heuristic methods are discussed for allocation of resources. We consider demand driven flexible personnel scheduling and rostering applications. Both cyclic and non cyclic rostering is developed as a network model and efficient computational methods discussed.

MILLS, Graham (CSIRO, Australia) *Network models for workforce allocation* (p. 15)
PANTON, David M (University of South Australia, Australia) *Column generation models for optimal workforce allocation with multiple breaks* (p. 16)
RYAN, David M (Department of Engineering Science, University of Auckland, New Zealand) *Optimised cell batching for an aluminium smelter* (p. 16)
SIER, David (CSIRO, Mathematical and Information Sciences, Australia) *Rostering ambulance officers: Network based algorithms* (p. 16)

MSP-004
Kinetic Equations in Semiconductor Modelling

William Robertson Building, Seminar Room 9

Organiser: MAUSER, Norbert J (University of Vienna, Vienna, Austria and Courant Institute, New York, USA)

Recent results in the modelling and analysis of kinetic models of charge transport in semiconductor devices are presented. In particular quantum mechanical formulations like the Wigner equation are useful for describing the transport in ultra-integrated or tunneling devices. Problems like boundary conditions, dissipative terms and long-time behaviour and the relation of quantum kinetics to classical kinetics are addressed. This minisymposium is related to the TMR network "Asymptotic Analysis of Kinetic Equations".

ARNOLD, Anton (TU-Berlin, Berlin, Germany) *The stationary boundary value problem for the Wigner equation* (p. 16)
DOLBEAULT, Jean (Univ. Paris IX, CEREMADE, Paris, France) *Asymptotic dispersion profile for kinetic equations and related models* (p. 16)
TOSCANI, Giuseppe (Dipartimento di Matematica, Universita' di Pavia, Italy) *Logarithmic Sobolev inequalities for kinetic semiconductor equations* (p. 17)
POUPAUD, Frédéric (Laboratoire J A Dieudonne, Universite de Nice, France) *Semiclassical limits in crystals* (p. 17)
SOLER, Juan (Granada University, Spain) *On Wigner/Schrödinger-type equations with dissipation and scattering effects for semiconductor devices: Stability and asymptotic behaviour* (p. 17)

MSP-005
The Role of Non-Hydrostaticity in Climate Dynamics of the Atmosphere, Ocean and Ice Sheets

David Hume Tower, Faculty Room South

Organiser: HUTTER, Kolumban (Institute of Mechanics, Darmstadt University of Technology, Germany)

Classical dynamic modelling of the atmosphere, the ocean and of ice sheets imposes a shallowness assumption - equivalent to a vertical hydrostatic balance - to simplify the governing equations. This restricts the scope of the reduced models and may falsify the results when applied without care. The renewal of the deep ocean water by convection and the so-called longitudinal stress-deviator effects in ice-sheet flow; but also the dynamics of the ice sheet-ice shelf transition zone, nonlinear barotropic and baroclinic waves and the atmospheric convection in the vicinity of sea ice edges are examples where non-hydrostatic effects are significant. The symposium addresses all climate modellers from meteorology, oceanography and glaciology.

MSP-007 William Robertson Building, Seminar Room 10
Applications of Knot Theory in Dynamics and Fluid Mechanics

Organisers: HOLMES, Philip J (Princeton University, USA)
GHRIST, Robert W (Georgia Institute of Technology, USA)

The mathematical theory of knots has of late reemerged from Lord Kelvin's "knotted æther vortices" to become a powerful tool in both dynamical systems and fluid mechanics. This collection of topological methods has great generality: applications to perfect fluids, MHD, and phase flows in general often proceed from a single theory, as in the case of "helicity". This minisymposium will focus on the interplay between the dynamics of flows and the topology of flowlines. The prevalent applications are to bifurcation invariants and the understanding of material flowlines in fluids, with respect to mixing, classification, and stability.

MSP-008 David Hume Tower, Faculty Room North
Finite Element Models in Low Frequency Electromagnetics

Organiser: FERNANDES, Paolo (Istituto per la Matematica Applicata del Consiglio Nazionale delle Ricerche, Italy)

Seen as a whole, the minisymposium is intended to give an overview of the different approaches currently used in the finite element solution of realistic magnetostatic and eddy current problems. These different approaches essentially arise from different choices of the unknown quantities in terms of which the problem is formulated. When potentials are used, the main issue is to make them unique by imposing partially arbitrary additional conditions, because they are not uniquely determined by the physical laws only. When fields are used, instead, the problem arises of correctly modelling the discontinuities that occur across the interfaces where different materials abut. The situation is made more intricate by the fact that efficiency considerations may lead to use different unknown quantities in different regions of the same problem.

MSP-009 Management School, Lecture Theatre 3
Pseudospectra: Theory and Applications

Organisers: AHUES, Mario (UMR CNRS, Université de Saint-Étienne, France)
LARGILLIER, Alain R (UMR CNRS, Université de Saint-Étienne, France)

The notion of a pseudospectrum has become a useful and efficient tool in applied mathematics. Different not always equivalent definitions have been proposed. The speakers are intended to discuss on these and on their corresponding applications. New techniques for the computation of pseudospectra will be presented. Applications will be exhibited in connection with the convection-diffusion operator, hydrodynamic stability, lasers, non-hermitian quantum mechanics and chemical kinetics.

GRAMMONT, Laurence (UMR CNRS, Université de Saint-Étienne, France) *Pseudospectrum: The principle of the thing* (p. 20)
SADKANE, Miloud (Department of Mathematics, Universite de Bretagne Occidentale, Brest, France) *Computation of pseudospectra by means of an harmonic l^1 approximation* (p. 20)
BERTRAND, Olivier (IRISA/INRIA-Rennes, France) *Counting the Eigenvalues which lie in a region of the complex plane.* (p. 20)
FRAYSSÉ, Valérie (CERFACS, France) *Pseudospectra at CERFACS* (p. 20)
TREFETHEN, Lloyd N (Oxford University, UK) *Applications of pseudospectra in physics* (p. 20)

MSP-015 David Hume Tower, Lecture Theatre C
Nonlinear Waves in Solids: Analytical and Numerical Aspects II
(see also Part I, MSP-014, p. 28; Part III, MSP-016, p. 64)

Organisers: MAUGIN, Gerard A (Universite Pierre Et Marie Curie, Laboratoire De Modelisation En Mecanique, Paris, France)
ENGELBRECHT, Juri (Estonian Academy of Sciences, Institute OF Cybernetics, Tallin, Estonia)
SAMSONOV, Alexander M (A I IOFFE Physico-Technical Institute, Russian Academy of Sciences, St Petersburg, Russia)

SAMSONOV, Alexander M (The Ioffe Institute of the Russian Academy of Sciences, Russia) *Bulk nonlinear elastic waves in inhomogeneous wave guides* (p. 29)
POUGET, Joel (Universite Pierre et Marie Curie, Laboratoire de Modelisation en Mecanique, Paris, France) *Nonlinear modulation of wave packets in a shallow shell on an elastic foundation* (p. 28)
MAUGIN, Gerard A (Universite Pierre et Marie Curie, Laboratoire de Modelisation en Mecanique, Paris, France) *Shock-wave and phase-transition-front structure by means of Eshelbian mechanics* (p. 27)
POTAPOV, Alexander I (Mechanical Engineering Research Institute, Russia) *Nonlinear interactions of solitary waves in a 2D lattice* (p. 28)
KAWAHARA, Takuji (Kyoto University, Japan) *Wave propagations in lattice models for nonlinear elastic structures* (p. 26)

MSP-018 Management School, Lecture Theatre 1
Inverse Problems in Imaging

Organisers: SCHERZER, Otmar (Institut für Industriemathematik, Universität Linz, Austria)
HANKE, Martin (Johannes-Gutenberg-Universität Mainz, Germany)

A large number of challenging mathematical problems arising in industrial applications can be formulated as Inverse Problems or Control Problems. In either case the goal is to adjust manufacturing parameters or to determine other, physical, quantities. Those numbers are required to run computer simulations and, eventually, to realize new industrial products. Depending on the application, the precise figures of these parameters may not be of primary importance. However, in applications where a parameter has a strong physical interpretation (like a thermal conductivity coefficient, for example), it is usually important that it be reconstructed qualitatively correct. This minisymposium will concentrate on applications from Computer Vision where the reconstruction of physical parameters is essential; it will address both, people from industry and researchers in applied mathematics.

WEICKERT, Joachim (University of Copenhagen, Denmark) *Restoration methods in computer vision* (p. 31)
RING, Wolfgang (Karl-Franzens Universität Graz, Austria) *Identification of a the load of a partially breaking beam from inclination measurements*
VOGEL, Curtis R (Montana State University, USA) *Inverse problems in atmospheric optics* (p. 31)
SCHOISSWOHL, Armin (Industrial Mathematics Institute, Johannes Kepler University Linz, Austria) *Image matching as an example of an inverse problem in medical imaging* (p. 30)
FRIGAARD, Ian (Schlumberger Dowell, Clamart, France) *Novel imaging-type problems arising in oilfield cementing* (p. 30)

MSP-021 William Robertson Building, Seminar Room 11

New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials III

(see also Part I, MSP-019, p. 13; Part II, MSP-020, p. 29; Part IV, MSP-022, p. 64; Part V, MSP-023, p. 82; Part VI, MSP-024, p. 102)

Organisers: FONSECA, Irene (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)
KINDERLEHRER, David (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)

GREENBERG, James M (Carnegie Mellon University, Pittsburgh, USA) *Antiplane shear flows in visco-plastic solids exhibiting isotropic and kinematic hardening* (p. 32)
SWART, Pieter J (Los Alamos National Laboratory, USA) *Modelling the ferroelectric perovskites*
LUSKIN, Mitchell (University of Minnesota, Minneapolis, USA) *Stability of microstructure in Martensitic crystals* (p. 33)
CHIPOT, Michel (Institut fuer Mathematik, Universitaet Zuerich, Zurich, Switzerland) *Computing microstructures* (p. 32)
WALKINGTON, Noel J (Carnegie Mellon University, Pittsburgh, USA) *New variational principles for approximating parabolic PDEs* (p. 36)

MSP-026 Appleton Tower, Lecture Theatre 1

Statistical Theories of Vorticity Structures in Navier-Stokes Turbulence

Organiser: HE, Xinyu (University of Warwick, UK)

In the theory of turbulence, constructing probability measures to describe spaces of vorticity structures, if indeed such measures exist, is still a challenging problem. The mini-symposium will present different approaches and new developments in this area.

KAMBE, Tsutomu (University of Tokyo, Japan) *Vortex structures and statistics of turbulence* (p. 37)
GIBBON, John D (Imperial College, London, UK) *The theory of vorticity dynamics in the three-dimensional Euler and Navier-Stokes equations* (p. 37)

MSP-035 David Hume Tower, Room 3.01

Analysis of Boundary Value Problems for PDEs III

(see also Part I, MSP-033, p. 14; Part II, MSP-034, p. 29)

Organiser: KRUTITSKII, Pavel (Moscow State University, Russia)

KONDRAT'EV, Vladimir A (Moscow State University, Russia) *On evolutionary equations in nonsmooth domains* (p. 44)
UMEZU, Kenichiro (Maebashi Institute of Technology, Japan) *Elliptic problems with nonlinear boundary conditions* (p. 46)
LASIECKA, Irena (University of Virginia, Charlottesville, USA) *Wellposedness and asymptotic behaviour in nonlinear dynamic elasticity* (p. 44)
ZHAO, Jennifer (University of Michigan-Dearborn, USA) *A nonlinear parabolic equation modeling sufactant diffusion* (p. 46)

MSP-036 Adam Ferguson Building, Room 19

Numerical Modelling with Functional Differential Equations I

(see also Part II, MSP-072, p. 68)

Organisers: BAKER, Christopher T H (University of Manchester, UK)
FORD, Neville J (University College Chester, UK)

Many real-life phenomena involve a delayed rather than instantaneous reaction, with a dependence on a memory of past events. Examples occur in economics, immunology, materials with memory, physiology, population dynamics, & robotics. Models of such phenomena frequently involve causal or Volterra-type functional differential equations (including retarded differential equations). For highly complex models, one requires numerical techniques that must be quantitatively accurate and qualitatively consistent. With such numerical methods at one's command, more realistic mathematical models can be used. The mini-symposium is intended to address the interaction between numerical analysis, algorithm construction, and deterministic or stochastic mathematical modelling.

MSP-042 Appleton Tower, Seminar Room 8

Industrial Applications of Particle Methods for Fluid and Granular Flow

Organisers: BARTON, Noel G (CSIRO Mathematical and Information Sciences, Australia)
NEUNZERT, Helmut (Institut fuer Techno- und Wirtschaftsmathematik, Germany)

This minisymposium focusses on recent industrial applications of particle methods like Smoothed Particle Hydrodynamics (SPH), Lattice Boltzmann Equation (LBE) methods, and the Discrete Element Method (DEM). SPH can be used to simulate momentum-driven flows with complicated physics and free surfaces; industrial applications include high pressure die-casting and high speed inflations. DEM can be used to simulate the flow of granular material; applications include grinding of mineral ores. Schemes based on a mesoscopic approach (LBE) can be applied to porous media flows in complex filter structures. This minisymposium will stress industrial applications and innovative aspects of these techniques.

MSP-044 William Robertson Building, Seminar Room 1

Mathematical Modelling and Prediction of Protein Structures

Organiser: MAINO, Giuseppe (ENEA, Applied Physics Division, Bologna, Italy, and University of Bologna, Ravenna, Italy)

The problem of accurately predicting the protein three-dimensional (3D) structure from the linear aminoacid sequence has yet to be solved. Each protein is folded into a specific 3D structure in which segments of alpha-helices and beta-strands (secondary structure) are packed together in various ways, thus making the prediction of its structure the key to understanding how it functions. In the last few years, the complete aminoacid sequence has been experimentally determined for a number of proteins and this fact has created the need for the development of reliable mathematical methods (statistical approaches, artificial neural networks, calculations from first principles, molecular dynamics and Montecarlo simulations, etc.) to analyse the vast amount of sequence data now available. This mini-symposium will be addressed to a review and discussion of the main techniques used in this field, with the participation of applied mathematicians, physicists and biologists.

MSP-045 George Square Lecture Theatre
Computational Science and Engineering: How to Organize? How to Teach?

Organiser: STRANG, Gilbert (Massachusetts Institute of Technology, USA)

It is true that an eigenvalue algorithm can help to solve a scientific or engineering problem without requiring a deep understanding of the application. But this distance between algorithm and application is closing fast. The words "Scientific Computing" partly reflected the change. Now highly interdisciplinary academic programs in the new field of Computational Science and Engineering (CS&E) are growing quickly. The applied mathematics societies are a natural home for this field.
The speakers in this minisymposium will discuss "teaching" of CS&E. They will address questions such as (1)what common elements should programs have? (2)how can disciplinary barriers be overcome? (3)for what careers are we preparing students? (4)what topics can we teach (and should we teach)?
The speakers will also describe their own experiences with specific programs in Europe and America. Those programs include industrial experiences in which students become highly involved.
The session will include an open discussion led by Gilbert Strang, so that members of the audience can describe their ideas and their experience with this fundamental development in applied mathematics.

MSP-050 Appleton Tower, Seminar Room 6
Hysteresis, Sweeping Processes and the Skorokhod Problem I
(see also Part II, MSP-051, p. 66)

Organiser: BROKATE, Martin (University of Kiel, Germany)

Rate independent evolutions appear in several subareas of mathematics and other sciences. One basic such model is known under the name "sweeping process" (Moreau) in convex analysis or as the "Skorokhod problem" in stochastics; it has also been studied in detail from the standpoints of evolution variational inequalities and hysteresis operators. From it, models with more complex memory structures like the Preisach model can be constructed. An effort is made to bring together from different fields people working on these problems.

MSP-076 David Hume Tower, Lecture Theatre B

Domain Decomposition Methods and Computation Mechanics I

(see also Part II, MSP-077, p. 68)

Organiser: NAKAMURA, Masaaki (Nihon University, Japan)

The recent progress in computer technology gives us a strong tool to analyze the nonlinear phenomena in various mechanics. In particular "Domain Decomposition Methods (DDM)", one of the newest technique of the computer simulation and "Computation Mechanics (BCM)", one of the main target to be analyzed by the computer simulation have the benefit of the vivid attention. The mini-symposium "Domain Decomposition Methods and Computation Mechanics" is inspired to points out the present problems and indicate the directions of the future research.

IKEDA, Tsutomu (Ryukoku University, Japan) *Numerical reproduction of the hexagonal convection pattern* (p. 78)
TOMOEDA, Kenji (Osaka Institute of Technology, Japan) *Numerical free boundary in a porous media equation with strong absorption* (p. 79)
FUJIMA, Shoichi (Ibaraki University, Japan) *A domain decomposition finite element scheme for flow problems* (p. 77)
HANADA, Takao (Chiba Institute of Technology, Chiba, Japan) *Numerical computation of Eguchi-Oki-Matsumura model* (p. 77)
ISHIWATA, Tetsuya (Ryukoku University, Shiga, JAPAN) *Analysis and numerical computation for blowing-up solutions arising in a model of curvature flow* (p. 78)

MSP-081 Appleton Tower, Room 2B

Wave Field Decomposition Methods in Direct and Inverse Scattering III

(see also Part I, MSP-079, p. 16; Part II, MSP-080, p. 29)

Organisers: KARLSSON, Anders (Department of Electromagnetic Theory, Lund Institute of Technology, Sweden)
FISHMAN, Louis (Naval Research Laboratory, USA)

OLSSON, Peter (Department of Mechanics, Chalmers University of Technology, Sweden) *Mechanical scattering problems for structural elements* (p. 81)
SJÖBERG, Daniel (Department of Electromagnetic Theory, Lund University, Sweden) *Wave decomposition in nonlinear, anisotropic media* (p. 82)
POWELL, Jeffrey O (Middle Tennessee State University, USA) *Trace formulae for two-parameter reconstruction in 1D inverse scattering* (p. 81)
KRISTENSSON, Gerhard (Dept of Electromagnetic Theory, Lund University, Sweden) *Homogenization of woven materials* (p. 81)

MSP-094 Appleton Tower, Lecture Theatre 5

HP and Spectral Methods for Composite Materials

Organisers: SCHWAB, Christoph (ETH Zurich, Switzerland)
SURI, Manil (Department of Mathematics and Statics, Univ. of Maryland, Baltimore County, USA)

Composite materials are increasingly the subject of intensive computational interest. These include not only the unidirectional (laminated) composites, but also woven composites such as ceramic matrix (CMCs) and polymer matrix (PMCs) which can greatly increase strength and toughness. Such materials, together with materials that exhibit periodic microstructure give rise to an important class of problems for which high order (p,hp, spectral) methods are just beginning to be applied. This minisymposium will survey both theoretical and computational results that point to the viability of such methods. It will be of interest to mathematicians as well as engineers.

CHARALAMBIDES, Panos G (University of Maryland, Baltimore County, USA) *A modified p-method finite element developed for the study of woven composites* (p. 95)
ANDERSSON, Börje B A (The Aeronautical Research Institute of Sweden) *Mathematical models for damage growth in composite materials* (p. 95)
MATACHE, Ana-Maria (Seminar for Applied Mathematics, ETH Zurich, Switzerland) *Generalized p - finite elements in homogenization* (p. 95)

MSP-111 William Robertson Building, Seminar Room 4

Degenerate Diffusion Equations I

(see also Part II, MSP-112, p. 69)

Organisers: KAWOHL, Bernd (Math Inst, University of Cologne, Germany)
WIEGNER, Michael (Lst. Math I, RWTH Aachen, Germany)

After intensive investigations of the porous medium equation over the last decade, the mathematical community with an interest in diffusion equations is currently focussing on models from a variety of applications. They include phenomena from astrophysics, biological diffusion and population growth, fluid dynamics of thin films on surfaces, combustion processes and differential geometric questions associated with crystal growth. In the minisymposium we will try to present the state of the art in particular for higher order equations.

BERNIS, Francisco (Universidad Autonoma de Madrid, Spain) *Higher order degenerate parabolic equations in lubrication theory* (p. 109)
HORSTMANN, Dirk (Mathematisches Institut der Universit"at zu K"oln, Germany) *Blowup results for solutions of a parabolic system modelling chemotaxis* (p. 110)
FILA, Marek (Comenius University, Slovakia) *Boundedness of global solutions to degenerate parabolic equations* (p. 109)

MSP-139 Appleton Tower, Lecture Theatre 2

Magnetohydrodynamics: MHD in Materials Processing, MHD Turbulence, Modelling of MHD Processes I

(see also Part II, MSP-140, p. 70; Part III, MSP-141, p. 87)

Organiser: DAVIDSON, Peter A (University of Cambridge, UK)

In the last decade we have witnessed a rapid growth in the application of magnetic fields to material processing. Magnetic fields are now routinely used to heat, stir, levitate, pump, stabilise and purify metals and oxides. This boom in industrial processing has led to a myriad of analytical and numerical studies, many of which concern the difficult problem of MHD turbulence. The purpose of these symposia is to indicate where we have got to in our understanding of electromagnetic processing of materials and of MHD turbulence, and to show the links to other branches of MHD, such as high magnetic Reynolds number turbulence.

ERNST, Roland (EPM MADYLAM, CNRS, France) *Inductive metallothermic process for material manufacturing* (p. 133)
COWLEY, Martin D (Engineering Department, University of Cambridge, UK) *Suppression of buoyant motion melts* (p. 132)
CROSS, Mark (University of Greenwich, UK) *Free surface melting* (p. 132)
GILLON, Pascale (EPM-MADYLAM CNRS, France) *Processing of materials using intense magnetic field gradients* (p. 133)
WIDLUND, Ola (Faxén Laboratory, Royal Institute of Technology, Sweden) *MHD turbulence models for engineering applications* (p. 135)

MSP-152 Adam Ferguson Building, Room 10

New Challenges in Control and Stabilization of Shells II

(see also Part I, MSP-151, p. 34)

Organisers: DELFOUR, Michel C (Centre de Recherches Matheématiques, Canada)
ZOLÉSIO, Jean-Paul (Ecole des Mines de Paris and CNRS, France)

BOURQUIN, Frédéric (Laboratoire des matériaux et des structures du génie civil, UMR113 LCPC/CNRS, France) *Rapid stabilization of plates: A numerical analysis* (p. 142)
DUBEAU, François (Université de Sherbrooke, Canada) *Impulsive ODE and numerical approximation of such equations* (p. 142)
MCMILLAN, Christine (Virginia Tech, USA) *Optimal control problems for shells* (p. 143)
VALENTE, Vanda (IAC-CNR, Rome, Italy) *Relaxed exact controllability of thin and membrane shells.* (p. 143)

MSP-183 Appleton Tower, Lecture Theatre 3

Ignition and Flame Propagation in Multiphase Media

Organisers: GOL'DSHTEIN, Vladimir (Department of Mathematics and CS, Ben Gurion University, Beer Sheva, Israel)
SOBOLEV, Vladimir A (Department of Mathematics, Samara State University, Samara, Russia)

The present minisymposium is concerned with theoretical investigation of combustion phenomena in multiphase media. Specifically, the two principal topics are in focus: ignition (self-ignition) and flame propagation. Researches are motivated by many realistic combustion problems: spray combustion, combustion in porous media, dusty gas combustion etc. Mathematical models are highly nonlinear singularly perturbed systems of ODE or PDE. Main methods are qualitative theory of differential equations, asymptotic methods (including integral manifolds method and "canard" theory), numerical simulations. Minisimposium oriented on experts in the mathematical combustion theory and the theory of singularly perturbed differential equations.

KUZMENKO, Grigory (Ben-Gurion University of the Negev, Israel) *Thermal explosion in sprays* (p. 169)
SHCHEPAKINA, Elena (Samara State University, Russia) *Canards and black swans in combustion* (p. 169)
GOL'DSHTEIN, Vladimir (Ben Gurion University, Israel) *Flame propagation in multiphase media* (p. 168)
SOBOLEV, Vladimir A (Samara State University, Russia) *Travelling waves of canard type* (p. 169)
DOLD, John W (UMIST, UK) *Flame ball stability in a dusty gas* (p. 168)

MSP-197 Management School, Lecture Theatre 5

Advanced Numerical Computing: Grid Generation and Solution Methods for Complex Applications I

(see also Part II, MSP-198, p. 71)

Organiser: SPITALERI, Rosa Maria (Istituto per le Applicazioni del Calcolo-CNR, Roma, Italy)

Advanced numerical simulation of a large series of applications needs being able to combine appropriate domain discretization methods and efficient solution procedures of complex differential models, along with visual investigation of computed data. The minisymposium presents recent advances in grid generation and solution methods for the simulation of complex applications. Complexity deals with properties of the problem domain, characteristic variables and computational strategy. Effective numerical methods for efficiently gridding physical domains and computing the solution of partial differential equations are presented, along with visual aspects. It would like to be a useful chance to group together method developers and users.

COSSU, Rossella (Istituto per le Applicazioni del Calcolo, CNR Roma, Italy) *Color spaces for vectorial data visualization in computational simulation* (p. 180)
BELLA, G (University of Rome, Italy) *Digital physics simulations of reactive flows* (p. 180)
MANZI, Cristina (Center of Advanced Studies, Research and Development in Sardinia, Italy) *Three dimensional mesh generation for the simulation of blood flow in complex human vascular districts* (p. 181)
HAUSER, Jochem (Center of Logistics and Expert Systems, Salzgitter, Germany) *Aerodynamic simulation of Ariane5 flight using an extreme number of blocks*

MSP-212 Management School, Lecture Theatre 4

Industrial Research Successes

Organisers: MCLAUGHLIN, Joyce (Rensselaer Polytechnic Institute, Troy, New York, USA)
OCKENDON, Hilary (Oxford University, OCIAM, UK)

Women mathematicians from the US, Australia and Europe will describe industrial problems and their solution. Talks will include mathematical modeling, large scale computation and data analysis. (Sponsored by Association for Women in Mathematics (AWM), European Women in Mathematics (EWM) and the Society for Industrial and Applied Mathematics (SIAM.)

CHANG, Rosemary E (SGI, USA) *Visualization of models with freeform surfaces* (p. 190)
WRIGHT, Margaret H (Bell Laboratories, Lucent Technologies, USA) *Better, bigger and beyond* (p. 191)
LANDMAN, Kerry A (University of Melbourne, Australia) *Mathematics - the invisible achiever* (p. 190)
VAN DE FLIERT, Barbera W (University of Twente, The Netherlands) *Evaporation and stress-driven diffusion: a generalised Stefan problem in paint* (p. 191)

MSP-228
Numerical Methods for Tracking Material Interfaces

Appleton Tower, Lecture Theatre 4

Organisers: LI, Xiaolin (SUNY at Stony Brook, USA)
ASLAM, Tariq D (Los Alamos National Laboratory, USA)

Simulation of Multi-material and multi-phase fluid interface instabilities remains difficult numerically. The importance of tracking the material interface has been widely accepted not only because it prevents unphysical numerical diffusion across the interface, but also because it is imperative to enforce the correct equation of states for different materials. In this minisymposium, we present different numerical algorithms to describe and track the dynamically evolving material interface, and to couple between the states of interface and interior. The methods to be presented in this minisymposium include the front tracking method, the level set tracking method, the volume of fluid methods, and the fluid mixture model.

ASLAM, Tariq D (Los Alamos National Laboratory, USA) *Level set algorithms for tracking discontinuities in hyperbolic conservation laws* (p. 201)
LI, Xiaolin (SUNY at Stony Brook, USA) *Three dimensional front tracking and shock-contact interaction* (p. 201)
KARLSEN, Kenneth H (Department of Mathematics, University of Bergen, Norway) *A fast level set method for reservoir simulation* (p. 201)
SHYUE, Keh-Ming (National Taiwan University, China) *A fluid-mixture type algorithm for compressible three-phase flows* (p. 202)
RIDER, William J (Los Alamos National Laboratory, USA) *Stirred, but not shaken, mixing the stretched and torn* (p. 201)

MSP-232
Risk Management

William Robertson Building, Lecture Theatre 8

Organisers: CAIRNS, Andrew (Heriot-Watt University, UK)
MACDONALD, Angus (Heriot-Watt University, UK)

In recent years there have been a number of highly publicised examples of financial institutions running into problems when complex financial contracts go wrong or stock markets become very volatile. This session will look at how such risks can be controlled through the use of adequate reserving and management strategies backed up by mathematical theory.

DELBAEN, Freddy (ETH, Zurich, Switzerland) *Is VaR really measuring risk?* (p. 203)
ROWAN, John (Bank of Scotland, UK) *Practical considerations of risk management for senior executives* (p. 203)
KEMP, Malcolm (Threadneedle Investment Managers, UK) *How effective is dynamic hedging of derivatives?* (p. 203)
CAIRNS, Andrew (Heriot-Watt University, UK) *Risk management for pension funds* (p. 203)

MSP-240
Parallel Solution Methods in Structural Analysis

David Hume Tower, Room 4.01

Organiser: LENHARDT, Ingrid (University of Karlsruhe, Institute for Applied Mathematics, Germany)

The application of the finite element method to problems from structural analysis usually leads to nonlinear systems of equations with large and sparse stiffness matrices that can be extremely ill-conditioned. The large scale of the problems require the use of parallel computers in combination with efficient iterative solvers. It is the purpose of this minisymposium to give a perspective of the development of parallel solution techniques in the structural analysis. The speakers will describe recent results in the field of mathematical software for problems from structural analysis on parallel architectures focussing on domain decomposition and equation solving.

11.00 – 13.00 Contributed Presentations: Lectures

C-5 Adam Ferguson Building, Room 13
Partial Differential Equations I
Chair(s): SPIVAK; R SAXTON

11.00–11.15 GASSER, Ingenuin (Institut für Angewandte Mathematik, Universität Hamburg, Germany) *On the vanishing Debye length limit in the drift diffusion model for semiconductors* (p. 261)
11.15–11.30 FURIHATA, Daisuke (Research Institute for Mathematical Science, Kyoto University, Japan) *Finite difference schemes for nonlinear wave equations that inherit energy conservation or momentum conservation property* (p. 260)
11.30–11.45 SPIVAK, Alexander (Technological Institute affilated with Tel-Aviv University, Israel) *Exit problem for Kramer's model* (p. 312)
11.45–12.00 SHEARER, Michael (North Carolina State University, USA) *Undercompressive shocks in thin film flow* (p. 309)
12.00–12.15 BARUCQ, Hélène (Université de Pau et des Pays de l'Adour, Pau, France) *Outflow boundary conditions for first-order pseudo-differential systems* (p. 240)
12.15–12.30 SAXTON, Katarzyna (Loyola University, New Orleans, USA) *Nonlinear dissipative-hyperbolic equations modelling propagation of second sound* (p. 306)
12.30–12.45 SAXTON, Ralph (University of New Orleans, USA) *The influence of large data on formation of singularities in incompressible fluids* (p. 306)
12.45–13.00 BERGLEZ, Peter (Department of Mathematics, Graz University of Technology, Austria) *On the solution of a generalized Stokes-Beltrami system* (p. 241)

C-6 Adam Ferguson Building, Room 14
Ordinary Differential Equations
Chair(s): REYNOLDS; SCHWARTZ

11.00–11.15 WANG, Shin-Hwa (Department of Mathematics, National Tsing Hua University, Taiwan) *An exact multiplicity theorem involving concave-convex nonlinearities and its application to stationary solutions of a singular diffusion problem* (p. 325)
11.15–11.30 ROUSSOS, Nicolette (University of the Witwatersrand, Johannesburg, South Africa) *Applications of lie symmetry methods to nonlinear, dynamic boundary value problems in finite elasticity* (p. 305)
11.30–11.45 REYNOLDS, David W (Dublin City University, Ireland) *Model problem for creep buckling and instability* (p. 303)
11.45–12.00 IWASAKI, Yoshimitsu (Okayama University of Science, Faculty of Informatics, Japan) *Physico-mathematical interpretation of the multiple anelastic relaxation in solids* (p. 273)
12.00–12.15 STEINER, Joseph M (Swinburne University of Technology, Australia) *Trajectory characteristics of planar Grassmann mechanisms* (p. 313)
12.15–12.30 SHADMAN, Dariush (Department of Mathematics, Sharif University of Technology, Tehran, Iran) *On the periodic solution of a nonlinear nth order differential equation* (p. 309)
12.30–12.45 SCHWARTZ, Ira B (US Naval Research Laboratory, USA) *Sustaining chaos using basin boundary saddles* (p. 307)
12.45–13.00 ZERNOV, Oleksandr E (Odessa State Polytechnic University, Ukraine) *On continuously differentiable solutions of the singular initial value problem* (p. 331)

C-7 Adam Ferguson Building, Room 17

Applied Probability and Statistics I

Chair(s): NAKANO; SCOZZAFAVA

11.00–11.15 KANEKO, Akihiko (University of Tokyo, Japan) *On a non-linear modelling analysis for complex time series* (p. 276)

11.15–11.30 KAWAMURA, Takeshi (Kitami Institute of Technology, Japan) *Γ-stability analysis with monotonicity conditions* (p. 276)

11.30–11.45 NAKANO, Yuji (Shiga University, Japan) *On a local causal analysis of time series* (p. 292)

11.45–12.00 KONTOROVICH, Valeri Ya (CINVESTAV-IPN Mexico) *Envelope and phase for narrow-band random processes with jumps.* (p. 279)

12.00–12.15 DE MESTRE, Neville J (Bond University, Australia) *Tournament roulette* (p. 252)

12.15–12.30 DE MAGALHÃES, Maysa S (Department of Industrial Engineering, Pontifícia Universidade Católica do Rio de Janeiro, Brazil) *Adaptive $\bar{X}$ charts - an economic model* (p. 252)

12.30–12.45 SCOZZAFAVA, Romano (Universita' La Sapienza, Roma, Italy) *Medical diagnosis by coherent probabilistic reasoning* (p. 307)

12.45–13.00 FERNÁNDEZ-GAUCHERAND, Emmanuel (University of Arizona, USA) *Controlled Markov processes with risk-sensitive average optimality criteria* (p. 259)

C-23 Adam Ferguson Building, Room 18

Fluid Mechanics I

Chair(s): SERGEEV; DEVENISH

11.00–11.15 DZIECIELAK, Ryszard (Poznan University of Technology, Poland) *Permeability tensor for heterogeneous porous medium of fibre type* (p. 256)

11.15–11.30 CHERNYSHENKO, Sergei I (Department of Mathematics, University of Manchester, UK) *Uniqueness of steady flow past a rotating cylinder with suction* (p. 248)

11.30–11.45 SERGEEV, Yuri A (Department of Engineering Mathematics, University of Newcastle, UK) *Chapman-Enskog closure approximation in the kinetic theory of turbulent suspensions with application to a gas-particulate pipe flow* (p. 308)

11.45–12.00 EGOROVA, Lidia A (Institute of Mechanics, Moscow State University, Moscow, Russia) *Interaction between electron exited nitrogen and non-uniform catalytic surface* (p. 257)

12.00–12.15 RUBINSTEIN, Isaak (Jacob Blaustein Institute for Desert Research, Ben-Gurion University of the Negev, Israel) *Electroconvective mechanisms in concentration polarization at electrodialysis membranes* (p. 305)

12.15–12.30 ZALTZMAN, Boris (Jacob Blaustein Institute for Desert Research, Ben-Gurion University of the Negev, Israel) *Electroosmotic slip of the second kind and instability in concentration polarization at electrodialysis membranes* (p. 331)

12.30–12.45 DEVENISH, Benjamin J (University of Newcastle, UK) *A PDF model for dispersed particles with inelastic particle-wall collisions* (p. 254)

12.45–13.00 RASUO, Bosko (University of Belgrade, Faculty of Mechanical Engineering, Aeronautical Department, Yugoslavia) *On solving boundary value problem in fluid mechanics by Fourier's method* (p. 302)

C-30 Appleton Tower, Room 2.A2

Numerical Methods in Differential Equations I

Chair(s): PEROTTO; XENOPHONTOS

11.00–11.15 CAI, Xiao-Chuan (Department of Computer Science, University of Colorado at Boulder, Boulder, USA) *Simulating 3D compressible flows by coupling multiple models* (p. 245)

11.15–11.30 WEVER, Utz (Siemens AG Corporate Technology, Munich, Germany) *The calculation of sensitvities for optimization problems in fluid dynamics* (p. 326)

11.30–11.45 PEROTTO, Simona (Politecnico di Milano, Dipartimento di Matematica "F. Brioschi", Milan, Italy) *An adaptive method for Boussinesq equations* (p. 298)

11.45–12.00 JELEN, Jaroslaw A (NOVA Research & Technology Co, Canada) *Non-iterative solution of Navier-Stokes equations* (p. 274)

12.00–12.15 ISMAIL, Mohammad S (King Abdul Aziz University, Saudi Arabia) *A predictor-corrector scheme for the sine-Gordon equation* (p. 272)

12.15–12.30 MEHRI, Bahman (Department of Mathematical Sciences, Sharif University Of Technology, Tehran, Iran) *Numerical solution of Neumann problem for a nonlinear Poissons equation* (p. 287)

12.30–12.45 XENOPHONTOS, Christos (Department of Mathematics and Computer Science, Clarkson University, Potsdam, USA) *Application of the p-version of the finite element method to elasto-plasticity with localization of deformation* (p. 328)

12.45–13.00 ITOH, Toshiaki (The University of Tokushima, Japan) *Discretization of ordinary differential equations that have exact solutions* (p. 273)

C-37 William Robertson Building, Seminar Room 3

Geophysical Sciences and Computational Fluid Mechanics

Chair(s): GRØVER; GRAHS

11.00–11.15 PERGAMENT, Anna Kh (Keldysh In-te for Applied Mathematics, Russia) *Mathematical simulation of the filtration processes in domains with complicated forms* (p. 297)
11.15–11.30 MYASNIKOV, V P (Keldysh Institute for Applied Mathematics, Russia) *Acoustic logging modeling by refined Biots equation* (p. 291)
11.30–11.45 GRØVER, Bent (Department of Applied Mathematics and Theoretical Physics, University of Cambridge, UK) *Acoustic waves in locally stratified media* (p. 265)
11.45–12.00 COUET, Benoit (Schlumberger-Doll Research, Ridgefield, USA) *Distributed optimal control of oil-field reservoirs under uncertainty* (p. 250)
12.00–12.15 CUMINATO, José Alberto (University of São Paulo, Brazil) *Numerical calculation of unsteady three-dimensional free surface flows in container filling* (p. 251)
12.15–12.30 NAE, Catalin (National Institute for Aerospace Research, Romania) *Solution adaptive approach using unstructured meshes and flowfield parameters* (p. 292)
12.30–12.45 GRAHS, Thorsten (Institut für Angewandte Mathematik, Universität Hamburg, Germany) *Nonlinear anisotropic artifical dissipation for numerical approximations of conservation laws* (p. 264)
12.45–13.00 SANTOS, Luis C (Institute of Mathematics and Statistics, University of Sao Paulo, Brazil) *A quick overview of the research on CFD in Brazil* (p. 306)

C-41 Appleton Tower, Room 2D

Electromagnetics and Geophysics

Chair(s): YASHINA

11.00–11.15 IWASHITA, Takeshi (Department of Electical Engineering, Kyoto University, Japan) *Parallel finite element electromagnetic field analysis of moving materials* (p. 273)
11.15–11.30 VENKATESH, Prasana K (Schlumberger-Doll Research, USA) *On a Bayesian method of global optimisation* (p. 322)
11.30–11.45 YASHINA, Nataliya P (Institute of Radio Physics and Electronics, Kharkov, Ukraine) *Novel computer-aided methods in the time-domain theory of periodic and waveguide-type open resonators* (p. 329)
11.45–12.00 TRACEY, John (Maths Dept, Heriot-Watt University and Edinburgh Petroleum Services Ltd, Scotland, UK) *Transient two-phase flow in pipes and wellbores* (p. 318)
12.00–12.15 GALIEV, Shamil (University of Auckland, New Zealand) *Resonant amplification of earthquake waves in sedimenatary basins and hills* (p. 261)
12.15–12.30 No talk
12.30–12.45 No talk
12.45–13.00 No talk

C-51 David Hume Tower, Room 3.18

Mathematical Methods and Modelling

Chair(s): KRIVTSOV

11.00–11.15 DUAN, Jinqiao (Clemson University, USA) *Dynamical systems methods for geophysical/environmental modeling* (p. 255)
11.15–11.30 ASSATOUROVA, Julia (St Petersburg State Technical University, St Petersburg, Russia) *Financial models for decision making in trading business* (p. 238)
11.30–11.45 KRIVTSOV, Anton (University of Aberdeen, King's College, Aberdeen, UK) *Influence of nonconservative forces on stability of high speed drilling* (p. 281)
11.45–12.00 No talk
12.00–12.15 No talk
12.15–12.30 No talk
12.30–12.45 No talk
12.45–13.00 No talk

11.00 – 13.00 Contributed Presentations: Posters

P-1 David Hume Tower, Lower Foyer

Posters I

AWBI, Bassam (University of Perpignan, France) *Dual formulation of a quasistatic viscoelastic contact problem with Tresca's friction law* (p. 239)

DAVIDSON, Stuart (Greensboro College, USA) *Uniform heat flow past a circular hole with two symmetrically inclined radial edge cracks* (p. 252)

ALEKSANDROVA, Svetlana (Coventry University, UK) *Buoyant convection in a rectangular box with horizontal temperature gradient and strong vertical magnetic field* (p. 235)

BRAUN, Richard J (University of Delaware, USA) *Two phase viscous drop spreading* (p. 243)

PANDEY, Bishun D (Ohio State University, USA) *An exact solution to the problem of interaction of a simple wave with a shock wave* (p. 296)

WALHIN, Jean-François (Université Catholique de Louvain, Belgium) *The true claim amount and frequency distributions in presence of a Bonus-Malus system* (p. 325)

KUBOTA, Koichi (Dept. Information and System Engineerign, Chuo University, Tokyo, Japan) *A preprocessor for reverse automatic differentiation with recursive checkpointing* (p. 281)

CHRISTIANSEN, Edmund (Dept. Math.& Comp.Sc., Odense University, Denmark) *Computation of collapse states in limit analysis* (p. 248)

CARGO, Patricia (CEA-CEA Bruyeres, France) *Numerical resolution of the multidimensional bi-temperature magnetohydrodynamics equations* (p. 246)

KOLLMANN, Wolfgang (MAME, University of California Davis, USA) *Hybrid spectral-finite difference Navier-Stokes solver for spatially developing incompressible flows* (p. 279)

PERNICE, Michael (Center for High Performance Computing, University of Utah, USA) *Hybrid approaches for solution of large-scale systems of nonlinear equations* (p. 298)

SPENCER, Nicholas K (CSSIP, Adelaide, Australia) *Convex-programming completion of covariance matrices for direction-of-arrival (DOA) estimation* (p. 312)

WOLOVICH, William A (Brown University, USA) *A complete set of geometric invariants for algebraic curves* (p. 326)

VÉLEZ-REYES, Miguel (University of Puerto Rico-Mayagüez Campus) *Using subset selection methods for hyperspectral image processing* (p. 322)

ANTIMIROV, Maximilian Ya (Riga Technical University, Latvia) *Analytical solutions for the problems of the flowing into of the conducting fluid through the lateral side of the plane channel in a strong magnetic field* (p. 236)

KOROBEINIKOV, Victor P (Institute for Computer-Aided Design, Russian Academy of Sciences, Moscow, Russia) *Analysis of critical states of physical systems by catastrophe theory* (p. 279)

KUBENKO, Veniamin D (Institute ofMechanics of National Acadamy of Sciences, Ukraine) *Dynamics of the spherical inclusions in the endless cylindrical vessel containing flowing liquid* (p. 281)

ICIAM 99
5-9 July 1999

Tuesday, 6 July, Afternoon Session
Overview

	14.00 – 14.45 Plenary Lectures	
	M AVELLANEDA, *New Perspectives on Modeling Financial Risk*	MH
	K J BATHE, *Recent Advances in the Finite Element Analysis of Fluids, Shell Structures and their Full Interactions*	GS
	14.55 – 15.40 Plenary Lectures	
	F KIKUCHI, *Theoretical Aspects of Nedelec's Edge Elements Applied to Electromagnetic Problems*	GS
	Shu TEZUKA, *Quasi-Monte Carlo Methods for Financial Applications*	MH
	16.00 – 18.00 Mini-Symposia	
MSP-016	Nonlinear Waves in Solids: Analytical and Numerical Aspects III	DHT-C
MSP-022	New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials IV	WRB-11
MSP-025	Applications of Mathematical Models of Liquid Crystals	WRB-9
MSP-028	The Complexity of Cardiovascular Modelling	WRB-1
MSP-032	Novel Approximation Techniques in Engineering Design Optimization	DHT-4.18
MSP-046	On Theoretical and Applied Trends Involving Incompressible Navier-Stokes Equations	AT-1
MSP-047	Mathematical Modeling of Electromagnetics I	DHT-N
MSP-051	Hysteresis, Sweeping Processes and the Skorokhod Problem II	AT-6
MSP-054	Applied Nonlinear Dynamics of Lasers	WRB-10
MSP-067	Analysis of Iterative Methods for Linear Equations	MS-3
MSP-072	Numerical Modelling with Functional Differential Equations II	AFB-19
MSP-077	Domain Decomposition Methods and Computation Mechanics II	DHT-B
MSP-086	Scientific Computing in Chemical Engineering	AT-8
MSP-107	Fast Solution Methods for the Boundary Element Method	AT-4
MSP-112	Degenerate Diffusion Equations II	WRB-4
MSP-115	New Directions in Multibody Dynamics	MS-1
MSP-122	Finite Element Methods for the Spectra of Non-Compact Operators	AT-5
MSP-140	Magnetohydrodynamics: MHD in Materials Processing, MHD Turbulence, Modelling of MHD Processes II	AT-2
MSP-148	Optimal Control Applications and Methods	AFB-10
MSP-154	Mathematics for Models of Domain Coarsening and Coagulation	WRB-2
MSP-192	Towards Common Software Architectures for Computational Problem-Solving Environments?	DHT-3.01
MSP-198	Advanced Numerical Computing: Grid Generation and Solution Methods for Complex Applications II	MS-5
MSP-213	Research Results by Women Post Docs	MS-4
MSP-222	Integral Methods	AT-2B
MSP-223	Bubble Dynamics	DHT-S
MSP-235	Models for Asset and Derivative Prices	WRB-8
MSP-239	Modern Perspectives on Applied Mathematics in the Classroom	GS
MSP-246	Free Boundary Problems in Combustion	AT-3
	16.00 – 18.00 Contributed Presentations: Lectures	
C-8	Partial Differential Equations II	AFB-13
C-9	Dynamical Systems I	AFB-14

C-10	Optimization I	AFB-17
C-24	Fluid Mechanics II	AFB-18
C-31	Numerical Methods in Differential Equations IV	AT-2.A2
C-35	Numerical Analysis I	AT-2D
C-38	Applied Probability and Statistics II	WRB-3
C-50	Fluid Mechanics and Geophysical Science	DHT-3.18
	16.00 – 18.00 Contributed Presentations: Posters	
	This is the continuation of the morning session, see p. 58	

Also this evening		
19.00 - 20.30	**Congress Reception**, see p. 220	Royal Museum

Tuesday, 6 July, Afternoon Session
Details

14.00 – 14.45 Plenary Lectures

Plenary Lecture — McEwan Hall

M AVELLANEDA (Courant Institute of Mathematical Science, New York, USA)

New Perspectives on Modeling Financial Risk

Chair: L THOMAS (Edinburgh University, UK)

The foundations of quantitative finance were laid down back in the early 1950s, with Markowitz' work on portfolio analysis, and the mid-seventies, with the Black-Scholes-Merton option-pricing formula. Since then, the impact of Applied Mathematics in financial-econometric modeling has acccelerated t remendously, as evidenced by the large employment of mathematicians, physicists and computer scientists in the financial industry. In particular, the use of quantitative strategies for trading and portfolio risk-management has probably doubled over the past 10 years. These developments took place despite the fact that quantitative trading has been blamed for - and even " pronounced dead" - following each of the major market events of 1987, 1992, 1994 and more recently, 1997.
I will try to review here some of the innovative ideas proposed in the 1990 s regarding financial modeling. Significant effort has been devoted to implementing realistic inter-temporal **asset-pricing models** that are used to price and analyse portfolios containing thousands of securities, such as stocks, currencies, bonds and options. The numerical implementation of such models and their calibration to market has generated interesting ideas and helped separate the theory that looked good "on paper" from ideas that can be useful in practice. In particular, the use of optimization techniques and methods for stabilizing inherently ill-posed problems of estimating the paramenters of stochastic processes are becoming standard tools of the trade.
The other central idea is concerned with how to **manage volatility**, or market risk, through better models. As markets progressed into the 1990s, it was realised that market volatility has considerably more structure than suggested by the simple Black-Scholes world or, more generally, by naive econometric techniques. The negative correlation between volatility and prices in equity markets, or **skew**, and the convexity of the implied volatility curve in currency markets, or **smile**, are strong indications of the subtle nature of volatility. Not only are prices uncertain; volatility itself is uncertain. There are essentially two complementary paths which have been used to address this: one involves sophisticated parameterization (a la GARCH-ARCH/stochastic volatility) and the other involves more parsimonious models based on extending Black & Scholes using confidence intervals for the uncertain parameters. In either case, by using such techniques we can try to determine whether the relations between the values of financial assets produced by a particular model are truly robust or just simple artifacts of the underlying mathematics.

Plenary Lecture — George Square Lecture Theatre

K J BATHE (Massachusetts Institute of Technology, USA)

Recent Advances in the Finite Element Analysis of Fluids, Shell Structures and their Full Interactions

Chair: D F PARKER (Edinburgh University, UK)

The objective in this presentation is to summarize some recent advances in the finite element analysis of fluids, shell structures and their full interactions. For fluids, emphasis is given to the convection-dominated flow situations; for shells of general geometric shapes, advances are described to obtain optimal elements for membrane- and bending dominated situations; and for fully coupled situations between shells and fluids, the special analysis procedures used are presented. The mathematical models of the recent developments are summarized, applications using the techniques in practice are given and further desirable advances are described.

14.55 – 15.40 Plenary Lectures

Plenary Lecture George Square Lecture Theatre

F KIKUCHI (University of Tokyo, Japan)

Theoretical Aspects of Nedelec's Edge Elements Applied to Electromagnetic Problems

Chair: D F PARKER (Edinburgh University, UK)

Numerical analysis of electromagnetic problems is now quite important in wide fields of science and engineering. The application of the finite element method (FEM) to such ends is expected to be very effective especially for 3-D problems since FEM is well suited to deal with domains of complex geometry and various boundary conditions.
By introducing appropriate modeling to the Maxwell governing equations, we have various problems describing electromagnetic phenomena in practice. In FEM, we first derive weak forms to such problems, and then obtain discrete equations based on the use of finite elements. In this process, we are often obliged to rely upon the so-called Nedelec type edge elements to approximate vector fields with their rotations.
The effectiveness of the edge elements are now widely recognized through practical experiences. More specifically, such elements are usually free from the spectral pollution in eigenvalue problems, and they are robust to singularities caused by boundary geometry, e. g., reentrant corners. Furthermore, they are easy to compute the rotations of vectors and deal with the tangential boundary conditions.
However, it is not easy to show their mathematical validity since formulations using edge elements are usually based on some mixed variational principles and hence we must prove various conditions such as the inf-sup one, the discrete compactness, etc. Thus we will summarize theoretical results for the edge elements. In particular, we will discuss the discrete compactness properties required in theoretical analysis of such elements, and show such properties for a few simple elements over special meshes.

Plenary Lecture McEwan Hall

Shu TEZUKA (IBM Tokyo Research Laboratory, Japan)

Quasi-Monte Carlo Methods for Financial Applications

Chair: L THOMAS (Edinburgh University, UK)

The computational pricing of derivative securities is now one of the most important topics in the theory and practice of financial mathematics. Monte Carlo methods have been commonly used for this application, particularly for the pricing of path-dependent exotic options. However, their painfully slow convergence rate pushes the limits of even the fastest parallel supercomputers.
In the last five years, we have witnessed a dramatic improvement in the efficiency of Monte Carlo computation for this application. It is quasi-Monte Carlo methods that have played the key role as a breakthrough technology in this innovation. While Monte Carlo methods assume random numbers to provide probabilistic error bounds via the central limit theorem, Quasi-Monte Carlo methods use low-discrepancy sequences to allow deterministic error bounds via the Koksma-Hlawka theorem. Since the discrepancy of a set of points is a measure of its deviation from uniform distribution, a low-discrepancy sequence means a sequence of points whose distribution is extremely uniform.
In this talk, we first give an overview of recent advances in the generation of low-discrepancy sequences for practical use, then describe how to apply them to the problem of pricing financial derivatives. We also show several successful examples of practical applications of this technique to the pricing of complex derivatives, such as MBS, CMO, IAS, etc. We will conclude the talk by discussing future research directions.

16.00 – 18.00 Mini-Symposia

MSP-016 David Hume Tower, Lecture Theatre C

Nonlinear Waves in Solids: Analytical and Numerical Aspects III

(see also Part I, MSP-014, p. 28; Part II, MSP-015, p. 46)

Organisers: MAUGIN, Gerard A (Universite Pierre Et Marie Curie, Laboratoire De Modelisation En Mecanique, Paris, France)
ENGELBRECHT, Juri (Estonian Academy of Sciences, Institute OF Cybernetics, Tallin, Estonia)
SAMSONOV, Alexander M (A I IOFFE Physico-Technical Institute, Russian Academy of Sciences, St Petersburg, Russia)

KOSEVICH, Yuriy A (Max Planck Institute for Physics of Complex Systems, Dresden, Germany) *Dissipative interaction and anomalous surface absorption of bulk elastic waves at a two-dimensional defect in a solid* (p. 26)
DAI, Hui-Hui (City University of Hong Kong, Hong Kong) *Existence of kink waves in a modified Mooney-Rivlin elastic rod* (p. 25)
HILL, Sandra (Keele University, UK) *Nonlinear waves in a coated elastic half-space* (p. 26)
PORUBOV, Alexey V (AF Ioffe Physico-Technical Institute of the Russian Academy of Sciences, Russia) *Strain solitons in an elastic rod embedded in external medium* (p. 28)
TRIMARCO, Carmine (University Of Pisa, Italy) *On a progressing phase transition front* (p. 29)
SAXTON, Ralph (University of New Orleans, USA) *On second sound at the critical temperature* (p. 29)
KOSIŃSKI, Witold (Center of Mechanics and Information Technology, SPOKoMM, IPPT PAN, Poland) *Thermomechanical coupled waves in nonlinear medium* (p. 26)

MSP-022 William Robertson Building, Seminar Room 11

New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials IV

(see also Part I, MSP-019, p. 13; Part II, MSP-020, p. 29; Part III, MSP-021, p. 47; Part V, MSP-023, p. 82; Part VI, MSP-024, p. 102)

Organisers: FONSECA, Irene (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)
KINDERLEHRER, David (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)

SERRE, Denis A G (Ecole Normale Supérieure de Lyon, France) *Vorticity growth in swirling flows* (p. 35)
TRUSKINOVSKY, Lev (University of Minnesota, USA) *Mechanical behavior of discrete systems with multi-stable elements* (p. 36)
FRIESECKE, Gero (Mathematical Institute, University of Oxford, UK) *Existence theorems for quantum many-body systems via variational methods* (p. 32)
LIU, Chun (Penn State University, USA) *Some dynamic problems in the theory of liquid crystals* (p. 33)
KRISTENSEN, Jan (Mathematical Institute, University of Oxford, UK) *Quasiconvexity and Young measures* (p. 33)

MSP-025 William Robertson Building, Seminar Room 9

Applications of Mathematical Models of Liquid Crystals

Organisers: LESLIE, Frank M (University of Strathclyde, Glasgow, UK)
GARTLAND, E C (Kent State University, USA)

Liquid crystals are well known through their applications in various electro-optic displays. This is a rapidly expanding market and one demanding an increasingly improved product so that much effort is being expended upon new devices employing different physical phenomena. Our aim in this set of lectures is to show something of the diversity of behaviour that these anisotropic liquids exhibit, with special emphasis on aspects of interest for display applications. Mostly our interests focus on thermotropic liquid crystals, but we also highlight liquid crystal polymers which may become increasingly important for applications.

MSP-028 William Robertson Building, Seminar Room 1
The Complexity of Cardiovascular Modelling

Organisers: LARSEN, Jesper K (Math-Tech, Copenhagen, Denmark)
OLUFSEN, Mette (Center for Bio-Dynamics, Boston University, USA)

The human circulation comprises complex multiphysics subsystems in which soft tissue mechanics, fluid mechanics, and electrical field propagation interact. Knowledge gained from modeling the subsystems can be combined in a coarse model of the whole cardiovascular system. An example of such a modeling effort applied to a human patient simulator is demonstrated. This mini-symposium presents talks on four aspects of the cardiovascular system, i.e. the heart, the interaction between the heart and the circulation, the arterial system, and the venous system. The symposium should interest biomathematicians as well as applied mathematicians engaged in modeling complex systems or developing simulator environments.

MSP-032 David Hume Tower, Room 4.18
Novel Approximation Techniques in Engineering Design Optimization

Organiser: ALEXANDROV, Natalia M (NASA Langley Research Center, USA)

High-fidelity mathematical models and simulations, such as the Navier-Stokes equations of aerodynamics, are designed to approximate the physical phenomena they describe to a high degree of accuracy. However, their use in a repetitive procedure, for example, in iterations of an optimization algorithm, is prohibitively expensive. On the other hand, an improvement in design with lower-fidelity, cheaper models does not guarantee a corresponding improvement for the higher-fidelity problem. Ad hoc techniques for incorporating variable-fidelity models in optimization have been in use for a long time. The proposed session is concerned with analytically substantiated methods that facilitate the use of high-fidelity, expensive models in design optimization. The first talk presents a first-order approximation management framework (AMF) for dealing with models of varying physical fidelity in constrained single-discipline and multidisciplinary environments. The second talk deals with a zero-order AMF based on derivative-free optimization (DFO) for expensive constrained problems. The last two talks deal with using information from course-grid finite-element models to approximate fine-mesh quantities of interest in order to reduce the cost of doing optimization of processes governed by partial differential equations.

MSP-046 Appleton Tower, Lecture Theatre 1

On Theoretical and Applied Trends Involving Incompressible Navier-Stokes Equations

Organisers: DURÁN, Mario (Universidad Católica, Santiago, Chile)
PICASSO, Marco (Ecole Polytechnique Fédérale de Lausanne, Switzerland)

The incompressible Navier-Stokes Equations have been studied in a very large way and have played, indeed, an important role to describe the fluid motion. In this mini-symposium some engineering models involving this system of equations are discussed. More precisely, we summarize recent theoretical results about nonhomogeneous fluids and present closely linked industrial applications in solidification processes. It is of our major interest to include the magneto-micropolar fluid model as well as a related Stokes spectral problem.

MSP-047 David Hume Tower, Faculty Room North

Mathematical Modeling of Electromagnetics I

(see also Part II, MSP-048, p. 82; Part III, MSP-049, p. 102)

Organisers: AMMARI, Habib (Ecole Polytechnique, France)
BAO, Gang (University of Florida, USA)

The minisymposium will focus on significant recent developments in mathematical modeling of electromagnetics. Particular emphasis will be put on mathematical analysis, computational methods, and optimal design of the model problems. The topics include diffractive optics, photonic band gap structures, chiral media, magnetostatics, magnetic materials, thin coatings and finite element methods. The speakers will present model problems, discuss various mathematical and computational approaches, and highlight diverse applications to practical problems. The purpose of this minisymposium is to bring together a group of leading researchers working on diverse topics of modeling and computing in electromagnetics, to discuss recent developments, and to share up-to-date ideas with participants.

MSP-051 Appleton Tower, Seminar Room 6

Hysteresis, Sweeping Processes and the Skorokhod Problem II

(see also Part I, MSP-050, p. 49)

Organiser: BROKATE, Martin (University of Kiel, Germany)

MSP-054 William Robertson Building, Seminar Room 10
Applied Nonlinear Dynamics of Lasers

Organisers: SCHWARTZ, Ira B (US Naval Research Laboratory, USA)
ERNEUX, Thomas (Universite Libre de Bruxelles, USA)

Lasers are extremely important in many applications in which high speed processing is an issue, such as large capacity information transmission, multiplexing communication using Multimode lasers, and ultrafast optical processing systems. Because lasers are driven into nonlinear regimes, they exhibit numerous kinds of bifurcations, from mixed mode chaos in single mode systems, to turbulent-like behavior in multimode cavities. High operating speeds of modern lasers make it difficult to ascertain time series information, thus forcing modeling to be necessary in order to gain an understanding of the onset of instabilities. The speakers in this session consider theory guided by experiments in which the models are used to explain both local and global bifurcations from experiments. The mathematical techniques range from asymptotic methods to the computation of global invariant manifolds.

MSP-067 Management School, Lecture Theatre 3
Analysis of Iterative Methods for Linear Equations

Organisers: NEVANLINNA, Olavi (Helsinki University of Technology, Finland)
HUHTANEN, Marko T (Helsinki University of Technology, Finland)

Iterative methods for linear systems are used as an alternative for direct methods in scientific computing. While the behaviour of iterative methods for self-adjoint, or more generally, for normal operators is reasonably well understood, a wider variety of tools are needed for nonnormal problems. The purpose of the mini-symposium is to present different mathematical tools used in analysis of iterative methods and in applications of iterative methods. The emphasis is on functional and complex analytic as well as matrix analytic approaches.

MSP-072 Adam Ferguson Building, Room 19

Numerical Modelling with Functional Differential Equations II

(see also Part I, MSP-036, p. 48)

Organisers: BAKER, Christopher T H (University of Manchester, UK)
FORD, Neville J (University College Chester, UK)

MSP-077 David Hume Tower, Lecture Theatre B

Domain Decomposition Methods and Computation Mechanics II

(see also Part I, MSP-076, p. 50)

Organiser: NAKAMURA, Masaaki (Nihon University, Japan)

MSP-086 Appleton Tower, Seminar Room 8

Scientific Computing in Chemical Engineering

Organisers: LORY, Peter (University of Regensburg, Germany)
PESCH, Hans-Josef (University of Bayreuth, Germany)

In recent years competition in the process industries has grown substantially. Consequently this has stimulated the development and the application of mathematical modelling and simulation techniques. Both steady-state and dynamic problems arise in the field of chemical engineering. Their mathematical description leads to (often very large) systems of nonlinear equations, differential-algebraic systems and partial differential equations. The mathematical formulation allows the application of highly developed optimisation methods. A totally different approach relies on the learning capabilities of neural networks. The intended audience of this minisymposium includes applied mathematicians and chemical engineers from both academic and industrial environments.

MSP-107 Appleton Tower, Lecture Theatre 4
Fast Solution Methods for the Boundary Element Method

Organiser: HAYAMI, Ken (Department of Mathematical Engineering, Graduate School of Engineering, University of Tokyo, Japan)

Despite its advantage of boundary only discretization, the standard formulation of the Boundary Element Method (BEM) suffers from a severe computational bottleneck, since it requires the formation and solution of a system of linear equations with a dense matrix, which makes it difficult to apply BEM to large-scale 3-D problems. At present, there are several promising techniques to overcome this problem such as the multipole expansion, panel clustering and wavelet methods, which give sparse approximations with guaranteed accuracy. Presentation on each method will be given as well as a new Galerkin method which reduces the computational costs from another aspect.

HACKBUSCH, Wolfgang (Praktische Mathematik, University of Kiel, Germany) *Fast integration in 3D boundary element methods* (p. 105)
GRAHAM, Ivan G (University of Bath, UK) *Implementation of fast integration methods in 3D boundary elements* (p. 105)
SCHWAB, Christoph (ETH Zurich, Switzerland) *Wavelet Galerkin algorithms for boundary integral equations* (p. 106)
SAUTER, Stefan (University of Leipzig, Germany) *Fully discrete panel clustering* (p. 106)
HAYAMI, Ken (Department of Mathematical Engineering, Graduate School of Engineering, University of Tokyo, Japan) *Multipole method for 3-D elastostatics* (p. 106)

MSP-112 William Robertson Building, Seminar Room 4
Degenerate Diffusion Equations II
(see also Part I, MSP-111, p. 51)

Organisers: KAWOHL, Bernd (Math Inst, University of Cologne, Germany)
WIEGNER, Michael (Lst. Math I, RWTH Aachen, Germany)

GARCKE, Harald (Institut für Angewandte Mathematik, Universität Bonn, Germany) *On fourth order degenerate diffusion equations - theory and numerical simulation* (p. 109)
GRÜN, Günther (Institute for Applied Mathematics, University of Bonn, Germany) *Nonnegativity preserving convergent schemes for thin film equations* (p. 109)
SOUPLET, Philippe (Département de Mathématiques, Université de Picardie, INSSET, France, and Laboratoire de Mathématiques Appliquées, Université de Versailles, France) *Blow-up and global existence in a reaction-diffusion model with free boundary* (p. 110)
ZEIDLER, Martin (RWTH-Aachen, Aachen, Germany) *Localized blow up phenomena* (p. 110)

MSP-115 Management School, Lecture Theatre 1
New Directions in Multibody Dynamics

Organisers: SIMEON, Bernd (TU Darmstadt, Germany)
ARNOLD, Martin (DLR German Aerospace Centre, Wessling, Germany)

Multibody dynamics comprises industrial design of road and railway vehicles, robots, air- and spacecrafts. Further applications are biomechanics and dynamics of machinery. In these fields, numerical simulation has become a key technology. Today, research focusses on new topics such as coupling of subsystems modelled by differential-algebraic and partial differential equations. Special applications like virtual test drive environments play also an important role. The mini-symposium will present the state-of-the-art in these fields of multibody dynamics. It is part of a series of minisymposia promoted by the European Consortium for Mathematics in Industry (ECMI).

CAMPBELL, Stephen L (North Carolina State Univeristy, USA) *PDAEs and DAEs* (p. 112)
ARNOLD, Martin (DLR German Aerospace Centre, Institute of Robotics and System Dynamics, Germany) *Waveform relaxation and the coupled simulation of pantograph and catenary* (p. 112)
VÖGEL, Martin (Technische Universität München, Germany) *A virtual test driver for virtual cars* (p. 112)
WINCKLER, Michael J (Interdiscipinary Center for Scientific Computing, University of Heidelberg, Germany) *Optimal control problems in engine design* (p. 112)

MSP-122 Appleton Tower, Lecture Theatre 5

Finite Element Methods for the Spectra of Non-Compact Operators

Organiser: SURI, Manil (University of Maryland Baltimore County, USA)

Problems involving the spectra of non-compact operators arise in fields as diverse as magnetohydrodynamics, optical fibers, wave guides and the buckling of shells. The finite element approximation of such spectra is not as well understood as that for compact operators. For instance, the spectrum might contain eigenvalues of infinite multiplicity, and the approximations might be polluted by spurious eigenvalues. In this minisymposium, we will survey methods that have been used to overcome such problems (generally by using some underlying compactness properties of the operator) and obtain pollution-free convergent methods for various engineering applications.

RAPPAZ, Jacques (Ecole Polytechnique Federal de Lausanne, Switzerland) *Spectral pollution in finite element approximations and applications* (p. 119)
JOLY, Patrick (INRIA, France) *Numerical approximation of spectral problems arising in open waveguide problems* (p. 119)
GASTALDI, Lucia (Dipartimento di Matematica, Universita' di Brescia, Italy) *Finite element approximation of eigenproblems in mixed form* (p. 118)
SURI, Manil (University of Maryland, Baltimore County, USA) *On the approximation of the spectra for buckling problems* (p. 119)
DAUGE, Monique (Universite de Rennes 1, France) *On the Cosserat spectrum in polygons and polyhedra* (p. 118)

MSP-140 Appleton Tower, Lecture Theatre 2

Magnetohydrodynamics: MHD in Materials Processing, MHD Turbulence, Modelling of MHD Processes II

(see also Part I, MSP-139, p. 51; Part III, MSP-141, p. 87)

Organiser: DAVIDSON, Peter A (University of Cambridge, UK)

BRANDENBURG, Axel (Department of Mathematics, University of Newcastle, UK) *Dynamo action in MHD turbulence* (p. 131)
MOREAU, Rene J (Lab. EPM-MADYLAM, CNRS and INP de Grenoble, France) *MHD quasi-2D turbulent shear flows under high magnetic fields* (p. 134)
DAVIDSON, Peter A (University of Cambridge, UK) *Low magnetic Reynolds number turbulence* (p. 133)
THESS, Andre (Ilmenau University of Tech., Germany) *Numerical modelling of low RM turbulence* (p. 134)
BRANOVER, H (Ben Gurion University, Israel) *Similarities between MHD and atmospheric turbulence* (p. 132)

MSP-148 Adam Ferguson Building, Room 10

Optimal Control Applications and Methods

Organisers: MAURER, Helmut (Westfälische Wilhelms-Universität Münster, Institut für Numerische Mathematik, Germany)
PICKENHAIN, Sabine (Technische Universität Cottbus, Institut für Mathematik, Germany)

New advances in modeling, methods and algorithms for optimal control problems bear a great potential for industrial applications. The speakers will address both theoretical and numerical aspects of optimal control problems subject to control and state constraints. The talks will focus on the following issues: (1) numerical methods for solving boundary value problems and discretized control problems, convergence properties of algorithms; (2) sensitivity analysis and real-time control of perturbed control problems; (3) maximum principle for state constrained control problems. Industrial applications are discussed in biotechnology, robotics and mechanical engineering.

OBERLE, Hans Joachim (Universität Hamburg, Institut für Angewandte Mathematik, Germany) *Optimal feed rates for a fed-batch fermentation model with state constraints* (p. 139)
PICKENHAIN, Sabine (Technical University Cottbus, Germany) *Optimal control problems with first order PDEs and state constraints* (p. 140)
MAURER, Helmut (Westfälische Wilhelms-Universität Münster, Institut für Numerische Mathematik, Germany) *Sensitivity analysis for state constrained optimal control problems* (p. 139)
FELGENHAUER, Ursula (Technical University Cottbus,Institute of Mathematics, Germany) *First- and higher-order Ritz methods for constrained optimal control* (p. 139)

MSP-154 William Robertson Building, Seminar Room 2

Mathematics for Models of Domain Coarsening and Coagulation

Organiser: PEGO, Robert L (University of Maryland, College Park, USA)

Kinetic mechanisms of phase transitions that involve clustering and particle growth (Ostwald ripening) are of great interest in materials science, in aerosol physics and other subjects. Size distribution evolution, and phenomena such as gelation and asymptotically self-similar growth are challenging to understand mathematically. This minisymposium is intended to expose some significant recent progress concerning these issues for fundamental models such as the Smoluchowski coagulation equations, coagulation-fragmentation equations, and the Lifshitz-Slyozov model of coarsening.

PENROSE, Oliver (Heriot-Watt University, Edinburgh, UK) *Mathematical models of nucleation and coarsening in alloys: An overview* (p. 145)
NIETHAMMER, Barbara (University of Bonn, Germany) *Dynamics of the LSW mean field theory of coarsening* (p. 145)
VAZQUEZ, Juan J L (Facultad de Ciencias Mathemáticas, Universidad Complutense, Madrid, Spain) *Title to be confirmed*
WATTIS, Jonathan (Division of Theoretical Mechanics, University of Nottingham, UK) *Modelling nucleation and growth of clusters with coarse-graining techniques* (p. 145)

MSP-192 David Hume Tower, Room 3.01

Towards Common Software Architectures for Computational Problem-Solving Environments?

Organisers: HAGUE, Stephen J (Numerical Algorithms Group, Oxford, UK)
FORD, Brian (Numerical Algorithms Group, Oxford, UK)

Much attention is currently directed to the design, construction and use of problem-solving environments (PSEs); that is, software systems tailored for the solving of particular sets of computational problems, such as PDEs, neural networks, circuit design etc. This mini-symposium explores the assertion that common PSE software architectures are emerging (or is the building of each PSE, by its nature, essentially a "one-off" exercise?). How significant are current and emerging standards such as CORBA, DCOM, OpenGL, MPI, MathML, OpenMath etc. How should we design mathematical software to be embedded in a variety of PSEs? Because of their potential impact on the design, construction and use of PSEs, such questions are critically important to PSE developers and users.

POOL, James C T (California Institute of Technology, Pasadena, USA) *The PSEware project: Progress, issues and prognosis* (p. 176)
SHAW, Gareth J (Numerical Algorithms Group, UK) *Mathematical modelling in industry: Reports on the decision and Julius PSE projects* (p. 176)
HAGUE, Stephen J (Numerical Algorithms Group, Oxford, UK) *Building PSEs - "Let a hundred flowers bloom"?* (p. 176)

MSP-198 Management School, Lecture Theatre 5

Advanced Numerical Computing: Grid Generation and Solution Methods for Complex Applications II

(see also Part I, MSP-197, p. 52)

Organiser: SPITALERI, Rosa Maria (Istituto per le Applicazioni del Calcolo-CNR, Roma, Italy)

PAPARONE, Luigi (CIRA, The Italian Aerospace Research Center, Italy) *ZEN: An industrial flow solver for complex aeronautical applications* (p. 181)
PISTELLA, Francesca (Istituto per le Applicazioni del Calcolo-CNR, Rome, Italy) *A stable explicit scheme for the numerical integration ofthe Gross-Pitaevskii equation* (p. 181)
SPITALERI, Rosa Maria (Istituto per le Applicazioni del Calcolo, Rome, Italy) *Linear and nonlinear multigrid computation for accelerated solutions* (p. 181)

MSP-213
Research Results by Women Post Docs

Management School, Lecture Theatre 4

Organisers: MCLAUGHLIN, Joyce (Rensselaer Polytechnic Institute, Troy, New York, USA)
OCKENDON, Hilary (Oxford University, OCIAM, UK)

Women postdoctoral mathematicians will discuss their applied mathematics research. (Jointly sponsored by the Association for Women in Mathematics (AWM), the European Women in Mathematics (EWM), and the Society for Industrial and Applied Mathematics (SIAM)).

DE PILLIS, L G (Harvey Mudd College, Claremont, USA) *Modeling Cancer Tumor Growth with an Optimal Control Approach to Chemotherapy* (p. 191)
BERTOZZI, Andrea (Duke University, Durham, USA) *Undercompressive shocks in driven film flow* (p. 191)
ZENG, Yanni (Department of Mathematics, University of Alabama at Birmingham, USA) *Gas flow in thermal nonequilibrium and hyperbolic systems with relaxation* (p. 192)
CERF, Corinne (Université Libre de Bruxelles, Belgium) *Detecting the chirality of knots and links, with application to chemistry* (p. 191)

MSP-222
Integral Methods

Appleton Tower, Room 2B

Organiser: LARGILLIER, Alain R (Université Jean-Monnet de Saint-Étienne, France)

Whatever the finite dimensional numerical approximation may be, it is desirable for computational purposes not to work with large size matrices. In this context multigrid refinement techniques, accelerated schemes and parallel algorithms contribute in an efficient way to preserve high accuracy without increasing the dimension of the discretized problem.

LIMAYE, Balmohan V (Indian Institute of Technology Bombay, India) *Improving accuracy of approximate eigenelements of integral operators* (p. 197)
D'ALMEIDA, Filomena D (Faculdade de Engenharia da Universidade do Porto, Porto, Portugal) *Double iteration Newton like refinement for spectral elements of integral operators* (p. 197)
ALAM, Rafikul (Indian Institute of Technology Guwahati, India) *An acceleration in spectral approximation of integral operators* (p. 196)

MSP-223
Bubble Dynamics

David Hume Tower, Faculty Room South

Organisers: TRYGGVASON, Gretar (University of Michigan, Ann Arbor, USA)
BLAKE, John R (University of Birmingham, UK)

Predicting the behavior of bubbly flows is important for a wide range of technological processes ranging from the refining of copper to boiling heat transfer. Numerical modeling and simulations have recently lead to major advances in the understanding of such flows both at a scientific as well as an engineering level. This mini-symposium brings together experts in various aspects of the modeling and computation of bubbly flows. The talks in the mini-symposium will give a broad overview of the state of the art.

BLAKE, John R (University of Birmingham, UK) *Acoustic cavitation, sonoluminescence and sonochemistry* (p. 197)
MAGNAUDET, Jacques (Institut de Mecanique des Fluides de Toulouse, France) *Some aspects of the lift force on bubbles* (p. 197)
TRYGGVASON, Gretar (University of Michigan, USA) *Direct numerical simulations of many bubbles* (p. 198)
KOHNEN, Gangolf (Institut fuer Verfahrenstechnik, FB IW, Halle, Germany) *Developments in calculating bubbly flows using the Euler/Lagrange approach* (p. 197)
POPINET, Stephane (Universite Pierre et Marie Curie, France) *Coupling of radial and translational motion in small viscous bubbles* (p. 198)

MSP-235 William Robertson Building, Lecture Theatre 8

Models for Asset and Derivative Prices

Organisers: MACDONALD, Angus (Heriot-Watt University, UK)
CAIRNS, Andrew (Heriot-Watt University, UK)

Pricing of financial risk, whether under short-term financial instruments or long-term insurance contracts, requires models for asset prices. Much research effort is now directed towards the strong assumptions underlying dynamic hedging models, including incomplete markets and very long term contracts. This mini-symposium brings together work from both insurance and financial economics perspectives.

MØLLER, Thomas (Laboratory of Actuarial Mathematics, University of Copenhagen, Denmark) *Hedging of payment streams in insurance* (p. 205)
WILKIE, A D (Heriot-Watt University, UK) *Autoregressive stochastic models for investment variables or what goes up must come down* (p. 206)
SMITH, Andrew (Bacon & Woodrow, UK) *Incomplete markets and financial product pricing* (p. 205)
HODGES, Stewart (Financial Options Research Centre, University of Warwick, UK) *Derivatives valuation and hedging in incomplete markets* (p. 205)

MSP-239 George Square Lecture Theatre

Modern Perspectives on Applied Mathematics in the Classroom

Organisers: HOLMES, Mark H (Rensselaer Polytechnic Institute, USA)
KAPILA, Ashwani K (Rensselaer Polytechnic Institute, USA)

It is unfortunate how detached from the real world applied mathematics can appear to students in the typical university classroom. Moreover, it is unusual to have students use experimentation to help develop an understanding of the mathematical problems or the physical systems under study. In this mini-symposium several interesting examples will be presented that demonstrate effective and novel ways applied mathematics can be taught to address these concerns. All center around experimentation, some involve numerical simulations or tests while others use hands on projects with physical systems. They also facilitate student centered learning and cooperative projects involving other students and the instructor.

NG, Bart S (Indiana Univ. Purdue University at Indianapolis, USA) *An experimental course on mathematical modeling of physical systems* (p. 209)
KAPILA, Ashwani K (Rensselaer Polytechnic Institute) *Web-based modules linking mathematics and applications* (p. 209)
BORRELLI, Robert L (Harvey Mudd College, USA) *Using computers in the introductory ODE course* (p. 209)
SCHLEINIGER, Gilberto F (University of Delaware, USA) *An interactive module: Systems of ODEs with chemical engineering applications* (p. 209)
SIEGEL, Michael (New Jersey Institute of Technology, USA) *The NJIT Capstone course in applied mathematics and statistics* (p. 209)

MSP-246 Appleton Tower, Lecture Theatre 3

Free Boundary Problems in Combustion

Organisers: BRAUNER, Claude-Michel (Université Bordeaux 1, France)
DOLD, John W (UMIST, UK)

Combustion, the science of chemically reacting fluids, is an interdisciplinary field combining essential aspects of fluid mechanics, thermodynamics and chemistry. Combustion and Free Boundary Problems are very closely related: models based on activation energy have been widely adopted, in which reaction is confined to thin zones or flame sheets. Free boundary problems in combustion modelling pose extremely challenging analysis and computational problems, which require all the techniques of modern applied mathematics. The present minisymposium is intended to focus on recent advances in the subject, as well as to point at promising future research directions.

16.00 – 18.00 Contributed Presentations: Lectures

C-8 Adam Ferguson Building, Room 13

Partial Differential Equations II

Chair(s): CONSTANTIN; GRANDGIRARD

16.00–16.15 MELNIK, Roderick V N (University of Southern Queensland, Australia) *Mathematical and numerical analysis of hyperbolic models for shape-memory alloys* (p. 287)
16.15–16.30 MICHIELSEN, Bas L (ONERA, France) *A boundary integral equation for high frequency electromagnetic scattering problems* (p. 287)
16.30–16.45 CONSTANTIN, Adrian (University of Zurich, Switzerland) *Wave breaking in shallow water* (p. 249)
16.45–17.00 PASQUALI, Aldo (University of Florence, Italy) *Numerical simulations for ring spinning process* (p. 297)
17.00–17.15 LAI, Choi-Hong (University of Greenwich, UK) *An acoustic expansion method for the retrieval of noise signals in unsteady flow* (p. 283)
17.15–17.30 WANG, Hwai-Chiuan (Department of Mathematics, National Tsing Hua University, Hsinchu, Taiwan) *Semilinear elliptic problems in interior and exterior flask domains* (p. 325)
17.30–17.45 GRANDGIRARD, Virginie (Association Euratom-CEA, France) *Free boundary Tokamak plasma equilibrium computation in an infinite domain* (p. 264)
17.45–18.00 LUDWIG, Bruno (AEROSPATIALE Centre Commun de Recherches, France) *Boundary integral equations for the problem of acoustic scattering by an absorbing obstacle* (p. 285)

C-9 Adam Ferguson Building, Room 14

Dynamical Systems I

Chair(s): HABERMAN; FISCHER

16.00–16.15 BOOKER, Stuart M (Department of Mathematics, University of Dundee, UK) *Effective disruption of nonlinear electronic sub-systems* (p. 242)
16.15–16.30 STAEMPFLE, Martin (University of Glasgow, UK) *Computing the flow of dynamical systems with adaptive triangulation methods* (p. 313)
16.30–16.45 HABERMAN, Richard (Southern Methodist University, USA) *Slow passage through a saddle-center bifurcation* (p. 267)
16.45–17.00 VARLAMOV, Vladimir V (Departamento de Matematicas, Escuela Colombiana de Ingenieria, Bogota, Colombia) *Long-time asymptotic expansion for the Kuramoto-Sivashinsky equation in a disk* (p. 322)
17.00–17.15 SLEPYAN, Leonid I (Tel Aviv University and Institute for Industrial Mathematics, Israel) *Dynamic factor in impact, phase transition and fracture* (p. 311)
17.15–17.30 FENG, Bao-Feng (Kyoto University, Japan) *Numerical computation for stationary travelling-wave solutions of the Kuramoto-Sivashinsky equation: A rational spectral approach* (p. 259)
17.30–17.45 FISCHER, Oliver (Bilfinger + Berger Bauaktiengesellschaft, Germany) *Non-linear dynamic behaviour of inclined suspended cables* (p. 259)
17.45–18.00 AKHMETOV, Marat (West Kazakhstan Economical and Financial Institution, Kazakhstan) *The comparison method for vibroimpact mechanisms* (p. 234)

C-10 Adam Ferguson Building, Room 17

Optimization I

Chair(s): MULHOLLAND; FREDENHAGEN

16.00–16.15 SADOVSKI, Alexey L (Texas A&M University-Corpus Christi, USA) *A game approach to the solution of nonsmooth problems of mathematical programming* (p. 306)
16.15–16.30 BAUMANN, Helge (University of Hamburg, Germany) *Aeroassisted orbit transfer with finite thrust* (p. 241)
16.30–16.45 MULHOLLAND, Anthony J (Department of Mathematics, Glasgow Caledonian University, Glasgow, UK) *Fractal simulated annealing* (p. 290)
16.45–17.00 SØRENSEN, Allan (The Maersk Mc-Kinney Moller Institute for Production Technology, Odense University, Denmark) *A dynamical approach to global optimization* (p. 312)
17.00–17.15 GUHL, Florent (Cemagref, France) *Continuity constraint in optimization of water supply* (p. 265)
17.15–17.30 CONSTANS, Sophie (Cemagref de Bordeaux, France) *Linear formulation for optimizing disinfectant concentrations in water distribution networks* (p. 249)
17.30–17.45 FREDENHAGEN, Sigrid (Institute for Applied Mathematics, University of Hamburg, Germany) *Constrained nonlinear spline-interpolation* (p. 260)
17.45–18.00 VILAIN, Claire (INRIA, France and DIM, Chile) *Optimal power flow problem with parallelization of the security's constraints* (p. 323)

C-24 Adam Ferguson Building, Room 18

Fluid Mechanics II

Chair(s): OLAGUNJU; HERRERO

16.00–16.15 PONZIANI, Donatella (Dipartimento di Meccanica e Aeronautica, Universitá di Roma La Sapienza, Rome, Italy) *Perturbative theory and transition to turbulence in wall-bounded flows* (p. 299)
16.15–16.30 RASMUSSEN, Henrik Obbekaer (Department of Mathematics, University of Milan, Milano, Italy) *Solution of the energy transfer equation for two-dimensional turbulence* (p. 302)
16.30–16.45 OLAGUNJU, David O (Dept. of Math. Sciences, University of Delaware, Newark. USA) *Analysis of extensional behavior of viscoelastic filaments* (p. 294)
16.45–17.00 BATISCHEV, Vladimir Andreevich (Rostov State University, Russia) *Bifurcations of stationary regimes of fluid flow in viscous layers* (p. 240)
17.00–17.15 GOURLAY, Tim P (University of Adelaide, Australia) *The Maximum Sinkage of a Ship* (p. 263)
17.15–17.30 MORTAZAVI, Iraj (Mathematiques Appliques de Bordeaux, France) *Pressure field computation using a predictor-corrector method* (p. 290)
17.30–17.45 HERRERO, Henar (Universidad de Castilla-la Mancha, Ciudad Real, Spain) *Theoretical study of the bifurcations of a Bénard-Marangoni problem* (p. 269)
17.45–18.00 DROZDOVA, Julia (Gubkin State Academy of Oil and Gas, Russia) *Nonlinear interaction of waves in a channel with arbitrary cross-section* (p. 255)

C-31 Appleton Tower, Room 2.A2

Numerical Methods in Differential Equations IV

Chair(s): BICA; WANG

16.00–16.15 HARRIOTT, George M (Air Products and Chemicals, Inc) *Finite element heat exchanger computations* (p. 268)
16.15–16.30 KERN, Michel (INRIA France) *Using Gröbner bases to compute higher order finite elements for mass lumping* (p. 276)
16.30–16.45 BICA, Ion (Schulmberger-Doll Research, USA) *Schwarz analysis of iterative substructuring algorithms for the p-version finite element method* (p. 242)
16.45–17.00 GUO, Ben Yu (Shanghai University, China) *Jacobi spectral approximations to singular differential equations* (p. 265)
17.00–17.15 ZIOLKO, Mariusz (Department of Electronics AGH, Poland) *A Wavelet-Galerkin approximation of hyperbolic partial differential equations* (p. 333)
17.15–17.30 DE MOURA, Carlos A (DCC/Univ. Fed. Fluminense, Brazil) *Parallel numerical schemes for evolutive differential equations* (p. 252)
17.30–17.45 WANG, Bei (University of Maryland College Park, USA) *Higher order Godunov scheme for gas dynamics with a nonconvex equation of state* (p. 325)
17.45–18.00 KAKO, Takashi (The University of Electro-Communications, Japan) *On the stability of Newmark's method for the second order equation with general dissipation term and its application to resistive MHD problem* (p. 275)

C-35 Appleton Tower, Room 2D

Numerical Analysis I

Chair(s): HATAUE; TABATA

16.00–16.15 HEGLAND, Markus (Australian National University, Australia) *Scalable thin plate splines* (p. 269)
16.15–16.30 HASEGAWA, Hidehiko (University of Library and Information Science, Japan) *Preconditioner's effects versus quadruple precision operations for Krylov subspace methods* (p. 268)
16.30–16.45 HATAUE, Itaru (Department of Computer Science, Kumamoto University, Japan) *Analyses of structure of spurious solutions in direct simulation of flow problem* (p. 268)
16.45–17.00 SHACHNO, Stepan M (Lviv State University, Lviv, Ukraine) *Difference analogue of Gauss-Newton method and its modifications* (p. 309)
17.00–17.15 RAPPOPORT, Juri M (Russian Academy of Sciences, Russia) *Comparison of numerical methods for* $K_{i\nu}(x)$ (p. 302)
17.15–17.30 YASSINE, Boubendir (Cerfacs, UMR MIP INSA-CNRS-UPS, Toulouse, France) *Boundary integral-domain decomposition method for solving the Helmhotz equation* (p. 329)
17.30–17.45 TABATA, Masahisa (Department of Mathematics, Kyushu University, Japan) *Finite element analysis of infinite Prandtl number Boussinesq equations and the Nusselt numbers* (p. 316)
17.45–18.00 CAMARGO-BRUNETTO, M Angelica De O (State University of Londrina, Brazil) *An algebraic algorithm for counting polynomial zeros in a circle using principle of argument and Chebyshev polynomials* (p. 245)

C-38 William Robertson Building, Seminar Room 3

Applied Probability and Statistics II

Chair(s): MATSUURA; OKABE

16.00–16.15 ARUN, C P (Department of Urology, Ayr Hospital, Ayr, UK) *Queueing theory in clinical practice: Application to the gastro-intestinal system* (p. 238)

16.15–16.30 TSAI, Hsien-Tang (Department of Business Management, National Sun Yat-Sen University, Taiwan) *A reversed two-tailed statistical test* (p. 318)

16.30–16.45 MATSUURA, Masaya (University of Tokyo, Japan) *On a non-linear causal analysis for complex time series* (p. 286)

16.45–17.00 YAMANE, Toshiyuki (University of Tokyo, Japan) *On a non-linear deterministic analysis for complex time series* (p. 329)

17.00–17.15 STARK, Robert M (University of Delaware, USA) *A conjecture based on the lognormal distribution* (p. 313)

17.15–17.30 HUZAK, Miljenko (Department of Mathematics, University of Zagreb, Croatia) *A generalization of some diffusion growth models* (p. 271)

17.30–17.45 OKABE, Yasunori (University of Tokyo, Japan) *On a non-linear information and prediction analysis for stochastic processes* (p. 294)

17.45–18.00 HOODA, D S (Department of Mathematics & Statistics, CCS Haryana Agricultural University, Hisar, India) *Generalized measures of useful directed-divergence and information improvement with applications* (p. 271)

C-50 David Hume Tower, Room 3.18

Fluid Mechanics and Geophysical Science

Chair(s): ZIEN; GRANDOTTO

16.00–16.15 ROSS, Andrew B (University of Strathclyde, Glasgow, UK) *Thin-film flow of a viscoplastic fluid* (p. 305)

16.15–16.30 WERTGEIM, Igor I (Institute of Continuous Media Mechanics, Russia) *Direct numerical simulation of nonlinear structures in non-isothermal channel flows* (p. 326)

16.30–16.45 ZIEN, Tse-Fou (Naval Surface Warfare Center, Dahlgren, Virginia, USA) *An integral method for skin friction and aerodynamic heating calculation* (p. 332)

16.45–17.00 PANFILOV, Mikhail (Oil and Gas Research Institute, Russian Academy of Sciences, Russia) *Nonlinear modes of gas-liquid flow with phase transitions in porous reservoir* (p. 296)

17.00–17.15 PANFILOVA, Irina (Oil and Gas Research Institute, Russian Academy of Sciences, Russia) *Instability threshold of capillary-gravity two-phase flow in porous medium* (p. 296)

17.15–17.30 TAMPIERI, Francesco (CNR Italy) *A generalized Fick law based on fractional derivatives* (p. 316)

17.30–17.45 GRANDOTTO, Marc (DRN/DEC/SECA CEA Cadarache, France) *Two phase flows numerical analysis with liquid and gas momentum equations* (p. 264)

17.45–18.00 CORTES, Julien (DRN/DEC/SECA CEA Cadarache, France) *Asymptotic analysis of the kinematic disequilibrium for compressible two-fluid flow* (p. 250)

ICIAM 99
5 - 9 July 1999

Wednesday, 7 July, Morning Session
Overview

	09.00 – 09.45 Plenary Lectures	
	Heinz W ENGL, *Nonlinear Inverse Problems, Regularisation Theory, Industrial Problems*	GS
	F P KELLY, *Mathematical Modelling of the Internet (Schlumberger Lecture)*	MH
	09.55 – 10.40 Plenary Lectures	
	H J PESCH, *Offline and Online Methods of Optimal Control and Differential Game Problems with Applications in Industrial Engineering*	GS
	S POPESCU, *What is quantum computation? (Schlumberger Lecture)*	MH
	11.00 – 13.00 Mini-Symposia	
MSP-023	New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials V	WRB-11
MSP-030	Electromagnetic Inverse Problems	AT-2B
MSP-048	Mathematical Modeling of Electromagnetics II	DHT-N
MSP-052	Impact and Friction in Contact Problems	AFB-19
MSP-055	Modelling and Analysis for Optical Communications; Beam and Pulse Propagation; Dispersion-Management I	WRB-10
MSP-059	Mathematical Methods in Solid Mechanics I	DHT-C
MSP-063	Mathematics Applied to Quantum Chemistry: Theoretical, Computational and Experimental Aspects I	DHT-4.01
MSP-068	Dynamical Problems in Fuels Pipelining	MS-1
MSP-078	Quasi-Monte Carlo Methods	WRB-8
MSP-096	Models, Analysis and Algorithms for Superconductivity I	WRB-9
MSP-113	Impulse Formulation of Fluid Flow	AT-1
MSP-119	Large Numbers of Students of Mathematics: How to Assess I	AT-3
MSP-127	High Resolution Implicit Multiphysics Simulation with Slide Surfaces	MS-3
MSP-130	Advances in Numerical Methods for Wave Propagation I	DHT-B
MSP-141	Magnetohydrodynamics: MHD in Materials Processing, MHD Turbulence, Modelling of MHD Processes III	AT-2
MSP-159	Infinite Networks and Continuous Transport Problem	DHT-4.18
MSP-164	Mathematical Modelling and Computational Aspects in Blood Flow I	WRB-1
MSP-169	The Mortar Element Method for High Order Discretizations: The Mortar Spectral Element Method, Other High Order Discretizations with Mortars I	AT-5
MSP-190	Spline Collocation Methods for Partial Differential Equations	AT-4
MSP-195	Phase Field Models and Prediction of Micro-Morphological Changes in Alloys I	WRB-2
MSP-199	Java for Computational Science and Engineering I	DHT-3.01
MSP-202	Spectral Problems in Differential Equations	AT-6
MSP-205	Methods of Dimension Reduction I	WRB-4
MSP-207	Warranty Modelling and Data Analysis	MS-5
MSP-211	Challenging Problems in Large-Scale Computing	MS-4
MSP-217	Differential Geometric Methods in Control and Design	AFB-10
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	11.00 – 13.00 Contributed Presentations: Lectures	
C-11	Numerical Methods in Differential Equations III	AFB-13
C-12	Fluid Mechanics III	AFB-14
C-13	Solid Mechanics	AFB-17

C-14	Asymptotics and Control Theory	AFB-18
C-32	Financial Mathematics and Probability	AT-2.A2
C-39	Signal and Image Analysis	WRB-3
C-42	Partial Differential Equations and Asymptotics	AT-2D
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Also this morning		
09.45	**1999 Henrici Prize presentation**, see p. 223	McEwan Hall

Wednesday, 7 July, Morning Session
Details

09.00 – 09.45 Plenary Lectures

Plenary Lecture — George Square Lecture Theatre

Heinz W ENGL (Johannes Kepler University, Linz, Austria)

Nonlinear Inverse Problems, Regularisation Theory, Industrial Problems

Chair: H NEUNZERT (Institut fuer Techno- und Wirtschaftsmathematik, Germany)

Inverse problems, i.e., problems where one looks for causes for a desired or an observed effect, are quite important in many applications in science and technology. We describe such problems arising in fields like nondestructive testing and steel processing (inverse heat conduction and parameter identification problems in casting and rolling of steel). Many of these problems are, in addition to being ill-posed, nonlinear. In recent years, the mathematical theory of methods for attacking nonlinear inverse problems has undergone major development. We survey results about convergence (with rates) of Tikhonov regularization for nonlinear ill-posed problems and then present recent results about convergence of iterative regularization methods for nonlinear ill-posed problems. Finally, we show that these methods can be efficiently applied to the industrial problems outlined.

Plenary Lecture — McEwan Hall

F P KELLY (University of Cambridge, UK)

Mathematical Modelling of the Internet (Schlumberger Lecture)

Chair: R BURRIDGE (Schlumberger-Doll Research, Ridgefield, USA)

Modern communication networks are able to respond to randomly fluctuating demands and failures by allowing buffers to fill, by rerouting traffic and by reallocating resources. They are able to do this so well that, in many respects, large-scale networks appear as coherent, almost intelligent, organisms. The design and control of such networks present challenges of a mathematical, engineering and economic nature.
This talk will describe how mathematical models are being used to address current issues concerning the stability and fairness of rate control algorithms for the Internet and for developing broadband networks.
Further information and references are available at http://www.statslab.cam.ac.uk/ frank/TALKS/mi.html

09.55 – 10.40 Plenary Lectures

Plenary Lecture George Square Lecture Theatre

H J PESCH (University of Bayreuth, Germany)

Offline and Online Methods of Optimal Control and Differential Game Problems with Applications in Industrial Engineering

Chair: H NEUNZERT (Institut fuer Techno- und Wirtschaftsmathematik, Germany)

First an overview of the state of the art of numerical methods for optimal control problems is given, by which optimal solutions can be computed for a wide range of problems governed by systems of ordinary or differential-algebraic equations including different kind of constraints. Several applications from the fields of aerospace engineering, robotics, process engineering, and vehicle dynamics are given.
Methods for online computations are not as well developed as offline methods. An overview of different approaches is given here with the emphasis on synthesis methods by which closed-loop controls can be approximated from the open-loop controls along bundles of trajectories. This method is also applicable to zero-sum differential game problems. By these problems optimal control problems under uncertainties for worst case scenarios can be modelled by assuming that the uncertainties are controled by an antagonistic second player. Applications from aerospace engineering and vehicle dynamics are given.

Plenary Lecture McEwan Hall

S POPESCU (Isaac Newton Institute, Cambridge, UK)

What is quantum computation? (Schlumberger Lecture)

Chair: R BURRIDGE (Schlumberger-Doll Research, Ridgefield, USA)

An introduction in quantum computation at a popular level. The basic ideas of quantum computation and some simple quantum algorithms will be presented, and the architecture of a quantum computer - quantum logical gates, and an experimental proposal for building a quantum computer using linear ion traps - will be described. This will be followed by a brief discussion of the problem of noise in quantum computation and the fundamental idea behind quantum error correction codes.

11.00 – 13.00 Mini-Symposia

MSP-023 William Robertson Building, Seminar Room 11

New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials V

(see also Part I, MSP-019, p. 13; Part II, MSP-020, p. 29; Part III, MSP-021, p. 47; Part IV, MSP-022, p. 64; Part VI, MSP-024, p. 102)

Organisers: FONSECA, Irene (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)
KINDERLEHRER, David (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)

PIRONNEAU, Olivier (University of Paris 6, France) *Application of automatic differentiation of computer programs to PDEs* (p. 35)
BALL, John M (University of Oxford, UK) *Models for surface relaxation* (p. 31)
KOWALCZYK, Michał (Carnegie Mellon University, Pittsburgh, USA) *Dynamics of single spikes in the Gierer-Meinhardt system* (p. 33)
FONSECA, Irene (Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, USA) *Relaxation results for constrained variational problems* (p. 32)

MSP-030 Appleton Tower, Room 2B

Electromagnetic Inverse Problems

Organiser: CHENEY, Margaret (Rensselaer Polytechnic Institute, USA)

Recovering the internal structure of a complex inhomogeneous medium or the shape of a scattering body, from data on scattered electromagnetic fields, are mathematical problems of significant interest. These problems lie at the core of such application areas as remote sensing, medical imaging, geophysical exploration, radar detection, and nondestructive testing. In this minisymposium, recent advances in mathematical techniques for addressing these problems will be presented.

WINEBRENNER, Dale P (University of Washington, USA) *Inversion of the 1-D Helmholtz equation: Application to the physical world* (p. 42)
CHENEY, Margaret (Rensselaer Polytechnic Institute, USA) *Acoustic and electromagnetic distinguishability in the half-space geometry* (p. 41)
CHERKAEVA, Elena (University of Utah, USA) *Inverse homogenization and the recovery of microstructural information in composite media* (p. 41)

MSP-048 David Hume Tower, Faculty Room North

Mathematical Modeling of Electromagnetics II

(see also Part I, MSP-047, p. 66; Part III, MSP-049, p. 102)

Organisers: AMMARI, Habib (Ecole Polytechnique, France)
BAO, Gang (University of Florida, USA)

BAO, Gang (University of Florida, USA) *Some mathematical issues in diffractive optics* (p. 53)
COSTABEL, Martin (Université de Rennes, France) *Nonsmooth electromagnetic problems and standard finite elements* (p. 54)
JOLY, Patrick (INRIA, France) *Space-time mesh refinement for Maxwell's equations* (p. 54)
NÉDÉLEC, Jean-Claude (Ecole Polytechnique, France) *Maxwell's equations in chiral media* (p. 55)

MSP-052
Impact and Friction in Contact Problems

Adam Ferguson Building, Room 19

Organiser: STEWART, David E (University of Iowa, Iowa City, USA)

The minisymposium is about the computational and mathematical treatment of contact problems with impact and Coulomb friction, which arise in robotics, manufacturing, realistic computer animations, and many other areas. Issues involved in these problems include: nonsmooth and/or discontinuous formulations; discontinuous velocities; and impulsive forces (with or without collisions). Typical approaches include complementarity problems, time-stepping methods, differential inclusions, and measure theory.

STIEGELMEYR, Andreas (Institute B for Mechanics, Technical University Munich, Germany) *Impacts with friction - Theory and practice* (p. 58)
KUNZE, Markus (Mathematisches Institut, Universitaet Koeln, Cologne, Germany) *On the application of Conley index theory to non-smooth dynamical systems* (p. 58)
STEWART, David E (Department of Mathematics, University of Iowa, Iowa City, USA) *Mathematics of impact and friction problems* (p. 58)
SCHATZMAN, Michelle (CNRS and Université Claude-Bernard Lyon 1, France) *Moreau's rule and penalty approximation* (p. 58)
ANITESCU, Mihai (Argonne National Labs, USA) *Time-stepping methods for stiff multi-rigid-body dynamics with contact and friction* (p. 57)

MSP-055
Modelling and Analysis for Optical Communications; Beam and Pulse Propagation; Dispersion-Management I

William Robertson Building, Seminar Room 10

(see also Part II, MSP-056, p. 103)

Organisers: SANDSTEDE, Björn (Ohio State University, Columbus, USA)
JONES, Christopher K R T (Brown University, Providence, USA)

The design of optical long-distance communication lines and all-optical signal-processing devices for reliable and high bit-rate transmission of information are important technological issues. Various schemes have recently been proposed to achieve higher transmission rates by compensating for dispersion and loss present in the fiber. Particularly exciting progress has been made in the dispersion-management of fibers. This minisymposium focusses the mathematical models, and their analysis, for these different mechanisms. Issues considered by presenters in the minisymposium include propagation of beams in waveguides, dispersion-managed fibers, spectral filtering and phase-sensitive amplification. Among the mathematical questions arising in the analysis of the relevant models are the existence, stability and interaction of localized waves to various equations. Most of the models involve nonlinear Schrödinger equations under various dissipative, conservative or non-local perturbations. In many cases, the PDEs are inhomogeneous due to jump conditions, which represent amplifiers or different materials used to assemble fibers. The analysis of these equations then requires the development of new techniques which are tailored to accommodate the particular features of the relevant PDEs. These needs have led to a considerable interaction between applied analysts and scientists working in nonlinear optics. Part I and II of this minisymposium focus on issues arising in the propagation of solitons in waveguides and fibers, and in dispersion-management, respectively.

ACEVES, Alejandro B (University of New Mexico, USA) *Pulse dynamics in nonlinear optical fibers with long and short period Bragg gratings* (p. 60)
KAPITULA, Todd (University of New Mexico, USA) *Stability of bright solitary-wave solutions to perturbed nonlinear Schrödinger equations* (p. 61)
TRILLO, Stefano (Fondazione ugo Bordoni, Italy) *Recent achievements in optical gap soliton theory* (p. 61)
YEW, Alice C (Ohio State University, USA) *Multiple pulses in dispersive quadratic media* (p. 61)

MSP-059 David Hume Tower, Lecture Theatre C

Mathematical Methods in Solid Mechanics I

(see also Part II, MSP-060, p. 103; Part III, MSP-061, p. 121; Part IV, MSP-062, p. 141)

Organisers: KAPLUNOV, Julius D (Institute for Problems in Mechanics, Russia)
WAN, Frederic Y M (University of California, Irvine, USA)

The minisymposium is dedicated to an outstanding scientist in the field of mechanics and applied mathematics Professor Eric Reissner (1913-1996). Among participants there are his friends, students and colleagues. The majority of presentations are concerned with the theory of shells and plates and related topics. Recent advances in non-linear wave propagation, computation mechanics, analysis of singularities and the theory of phase changes in solids are also discussed.

ALTENBACH, Holm (Martin-Luther-Universität Halle-Wittenberg, Halle, Germany) *On different approaches to the determination of the transverse shear stiffness in the plate theory* (p. 63)
GOLDENVEIZER, Alexei L (Institute for Problems in Mechanics, Russian Academy of Sciences, Russia) *Approaches for refining 2D shell theories* (p. 64)
GREGORY, R Douglas (Dept. of Mathematics, University of Manchester, UK) *A thick hollow sphere compressed by equal and opposite concentrated loads; An asymptotic solution* (p. 64)
KAPLUNOV, Julius D (Institute for Problems in Mechanics, Russian Academy of Sciences, Russia) *Edge and interfacial vibrations of shells and plates* (p. 64)
KIENZLER, Reinhold (University of Bremen, Department of Production Engineering, Germany) *On consistent higher-order plate and shell theories* (p. 64)

MSP-063 David Hume Tower, Room 4.01

Mathematics Applied to Quantum Chemistry: Theoretical, Computational and Experimental Aspects I

(see also Part II, MSP-064, p. 103; Part III, MSP-065, p. 121; Part IV, MSP-066, p. 141)

Organiser: LE BRIS, Claude (Ecole Nationale des Ponts et Chaussées, France)

These 4 mini-symposium are devoted to the mathematical analysis of the models of quantum chemistry. The purpose is to show to a large audience of applied mathematicians that quantum chemistry is a rich source of difficult and interesting mathematical problems, and can be a field of research that is still mostly unexplored. The lecturers come from both communities of mathematicians and chemists. Mathematical studies as well as examples of computations and open problems will be presented. The style of the talks will be deliberately pedagogic, and especially designed for a mathematician not familiar with this field of research.

BÉNARD, Marc (Universit'e de Strasbourg, France) *Algorithmic and numerical challenges in today's computational quantum chemistry* (p. 67)
SUTCLIFFE, Brian T (Lab. de Chimie Phys. Moleculaire, ULB, Bruxelles, Belgium) *Is a molecule in chemistry explicable as a broken symmetry in quantum mechanics?* (p. 70)
CAFFAREL, Michel (CNRS, Université Paris VI, France) *Solving the Schrödinger equation with probabilistic methods: Quantum Monte Carlo and quantum chemistry* (p. 67)
LE BRIS, Claude (Ecole Nationale des Ponts et Chaussées, France) *On the TDHF equations* (p. 69)
TURINICI, Gabriel M (Laboratoire ASCI-CNRS, Orsay, France) *Quantum control of chemical reactions* (p. 70)

MSP-068 Management School, Lecture Theatre 1

Dynamical Problems in Fuels Pipelining

Organisers: FASANO, Antonio (Ulisse Dini, University of Florence, Italy)
TERENZI, Alessandro (Snamprogetti, Italy)

The technology of fuels pipelining presents a considerable variety of physical, chemical and engineering problems of remarkable complexity, posing quite interesting questions also from the point of view of mathematical modelling. In this mini-symposium we want to illustrate some cases which are particularly interesting either because of the numerical techniques or because of the absolutely peculiar rheological properties of the fluid. The topics treated are: transport of gases at high Mach numbers, multiphase flow of diluted coal-water suspensions, the dynamics of liquid-liquid dispersions, and an overview of other classes of problems (rheological properties of coal-water slurries, sedimentation in pipelines, the flow of waxy crude oils).

TERENZI, Alessandro (Snamprogetti, BAPAC Dept., Italy) *Transient compressible flow at high mach numbers: A conservative method for pipline flow* (p. 73)
FASANO, Antonio (Dept.Math. "Ulisse Dini", University of Florence, Italy) *Fuels with peculiar rheological properties* (p. 72)
ROSSO, Fabio (Dept.Math. "Ulisse Dini", University of Florence, Italy) *Dynamics of liquid-liquid dispersions* (p. 72)
SPERANZA, Alessandro (Dept.Math. "Ulisse Dini", University of Florence, Italy) *Pipelining of diluted coal-water suspensions* (p. 73)
SONA, Giuliano (Dept.Math. "Ulisse Dini", University of Florence, Italy) *A mathematical model for gravity phase separation in liquid-liquid dispersions* (p. 72)

MSP-078 William Robertson Building, Lecture Theatre 8
Quasi-Monte Carlo Methods

Organisers: NIEDERREITER, Harald (Austrian Academy of Sciences, Austria)
TEZUKA, Shu (IBM Tokyo Research Laboratory, Japan)

Quasi-Monte Carlo methods are deterministic versions of Monte Carlo methods, in the sense that random samples in a Monte Carlo method are replaced by suitably chosen deterministic points. They are particularly effective in problems involving high-dimensional numerical integration. In recent years there have been spectacular applications in computational physics and mathematical finance in which they systematically outperformed Monte Carlo methods. The minisymposium will cover the error analysis of quasi-Monte Carlo methods, the generation of suitable deterministic points, and applications to mathematical finance. It will be of interest to numerical analysts and practitioners in scientific computing.

HICKERNELL, Fred J (Hong Kong Baptist University, China) *Error decay rates for Quasi-Monte Carlo quadrature* (p. 79)
NIEDERREITER, Harald (Austrian Academy of Sciences, Austria) *Constructions of quasirandom points* (p. 79)
PAPAGEORGIOU, Anargyros (Columbia University, USA) *Quasi-Monte Carlo for problems in mathematical finance* (p. 79)
SLOAN, Ian H (University of New South Wales, Australia) *On the tractability of Quasi-Monte Carlo integration* (p. 79)

MSP-096 William Robertson Building, Seminar Room 9
Models, Analysis and Algorithms for Superconductivity I
(see also Part II, MSP-231, p. 110)

Organiser: DU, Qiang (Hong Kong Univ of Science and Technology, Hong Kong, China)

Superconductivity is one of the grand challenges identified as being crucial to future economic prosperity and scientific leadership. In recent years, more and more applied mathematicians have started working on the analysis and numerical simulations of various mathematical models in superconductivity. There were plenary lectures and minisymposiums devoted to this subject in the 3rd ICIAM at Hamburg. Since then, many new studies have been made on topics ranging from the Ginzburg-Landau models to the mean field models. The works appeared so far can be categorized as follows: (1) the development or refinement of mezoscale and macroscale models for superconductivity so to enlarge the range of physical problems for which such models are valid; (2) the analysis of these models in order to gain further understanding of the properties of these models and of their solutions, and also to determine their validity and usefulness for solving physically interesting problems; (3) the development, analysis and the implementation of algorithms for the numerical simulation of solutions of the various models; (4) the application of the theoretical results, algorithms and codes in the practical study superconducting phenomena. The purpose of this minisymposium is to provide a forum for the experts in the area to present their latest research work. It also complements the plenary talk given by Dr. Chapman (Oxford University) at the Congress. The speakers come from different continents and their talks touch upon the mathematical, the numerical and the physical aspects of the problems in superconductivity.

ALMOG, Yaniv (Technion-I.I.T, Israel) *On the bifurcation and stability of periodic solutions of the Ginzburg-Landau equations in the plane* (p. 97)
BAUMAN, Patricia (Dept. of Mathematics, Purdue University, W. Lafayette, USA) *A three-dimensional superconductor in a strong magnetic field* (p. 97)
CHEN, Zhiming (Institute of Mathematics, Academina Sinica, Beijing, China) *Adaptive Galerkin methods for a dynamical GL model in superconductivity* (p. 97)
PHILLIPS, Daniel (Purdue University, USA) *Flux creep in High-Tc superconducting materials* (p. 97)
AFTALION, Amandine (DMI Ecole Normale Superieure, France) *On the solutions of the one dimensional Ginzburg-Landau equations for superconductivity* (p. 96)

MSP-113 Appleton Tower, Lecture Theatre 1

Impulse Formulation of Fluid Flow

Organiser: SUMMERS, David M (Napier University, UK)

The Hamiltonian formulation of the Navier-Stokes equation described by Oseledets in 1988 is attracting increasing interest. The equation of motion, expressed in terms of impulse density (alternatively described as: 'velicity', 'magnetization', 'impetus') is solved numerically using both lagrangian and eulerian methods. Recent application of these to Euler flow problems involving immersed boundaries will be presented. A gauge freedom attaches to the problem and the implication of this will be discussed. The formulation may be used to explore the statistical mechanics of fluid impulse. Problems associated with the treatment of viscous flow over solid boundaries will be examined.

OSELEDETS, Valery (Moscow State University, Russia) *Some remarks on velocity - impulse formulation* (p. 110)
CHORIN, Alexandre J (University of California, Berkeley, USA) *A new formulation of the near-equilibrium theory of turbulence* (p. 110)
RUSSO, Giovanni (Dipartimento di Matematica, Università dell'Aquila, Italy) *Impulse formulation of the Euler equations and fluid-membrane interaction* (p. 111)
CORTEZ, Ricardo (Tulane University, USA) *Computation of immersed boundary motions using impulse* (p. 110)
SUMMERS, David M (Napier University, UK) *Numerical impulse generation at a solid boundary* (p. 111)

MSP-119 Appleton Tower, Lecture Theatre 3

Large Numbers of Students of Mathematics: How to Assess I

(see also Part II, MSP-120, p. 105)

Organisers: BARRY, Michael DJ (University of Bristol, UK)
SIMS WILLIAMS, Jonathan H (University of Bristol, UK)
SUTHERLAND, Rosamund (University of Bristol, Graduate School of Education, UK)

More students than ever before study mathematics at university and most take it as a subsidiary subject. They find that mathematics is as difficult as it is vital and matters are not helped by the inevitable large classes. In some countries, notably the UK, teaching difficulties are aggravated due to a decline in traditional drill and practice. The minisymposium speakers will examine different methods of automatic assessment: that motivate students by aiming to teach via feedback, that direct study by targeting and pinpointing weaknesses, and that provide benchmarks of understanding whilst saving the time of over-pressed staff.

BEEVERS, Cliff E (Heriot Watt University, Edinburgh, UK) *The emerging philosophy behind computer based assessment* (p. 116)
LAWSON, Duncan A (Coventry University, UK) *Formative assessment using CAA* (p. 117)
GOLDFINCH, Judy (Napier University, Edinburgh, UK) *The Sumsman project and its implications for computer-based assessment* (p. 116)
SIMS WILLIAMS, Jonathan H (Bristol University, UK) *Open testing with a large databank of multiple choice questions* (p. 117)

MSP-127 Management School, Lecture Theatre 3

High Resolution Implicit Multiphysics Simulation with Slide Surfaces

Organiser: ARO, Colin J (Lawrence Livermore National Laboratory, USA)

High-resolution implicit multiphysics simulations require the solution of large, sparse, linear systems on massively parallel computers. The linear system is often nonsymmetric, indefinite, and can be very ill conditioned due to physical properties in the system, such as high aspect ratio elements, low material strength, very fine grid resolution, and the presence of slide (contact) surfaces. Nonstationary iterative methods can be very scalable and efficient in solving the linear system, but often break down for problems with "difficult" physical properties. Direct methods are more robust, but are difficult to implement in a scalable way for massively parallel simulations. This minisymposium will cover recent research toward the development of robust, reliable, scalable algorithms for massively parallel multiphysics simulations, and will be of interest to finite element modelers, and numerical mathematicians.

MSP-130 David Hume Tower, Lecture Theatre B

Advances in Numerical Methods for Wave Propagation I

(see also Part II, MSP-131, p. 106)

Organiser: HAGSTROM, Thomas (University of New Mexico, New Mexico, USA)

Problems in wave propagation have played and will continue to play a central role in the mathematical analysis of physical and biological systems. Crucial issues for time domain simulations of waves include the development of reliable, efficient solvers in complex geometries and for complex models as well as the derivation of accurate yet inexpensively implementable radiation boundary conditions at artificial boundaries. The speakers will discuss a range of exciting new developments on these fronts, and outline problems for future work as well.

MSP-141 Appleton Tower, Lecture Theatre 2

Magnetohydrodynamics: MHD in Materials Processing, MHD Turbulence, Modelling of MHD Processes III

(see also Part I, MSP-139, p. 51; Part II, MSP-140, p. 70)

Organiser: DAVIDSON, Peter A (University of Cambridge, UK)

MSP-159 David Hume Tower, Room 4.18

Infinite Networks and Continuous Transport Problem

Organiser: GWINNER, Joachim (Institute of Mathematics, Department of Aerospace Engineering, University of the Federal Army Munich, Germany)

By the work of Beckmann (1952, 1976) and Iri (1980), together with Taguchi (1982) it became apparent that the study of continuous transport problems is not only interesting for its own sake, but is important for the understanding of dense networks and for the effective numerical solution of large flow problems, as encountered e.g. in metropolitan road traffic. This mini-symposium focuses on recent progress in the field of infinite networks and application to continuous transport problems. Benefits and shortcomings of different approaches in the extension of the classical Ford and Fulkerson network theory are discussed.

MSP-164 William Robertson Building, Seminar Room 1

Mathematical Modelling and Computational Aspects in Blood Flow I

(see also Part II, MSP-252, p. 111)

Organiser: PONTRELLI, Giuseppe (IAC-CNR, Viale del Policlinico 137, Rome, Italy)

Fluid dynamics of blood in arteries plays a crucial role in the localization of deposits, formation of stenosis and aneurysms and in general in the genesis, development and prevention of cardiovascular diseases. Nowadays, computational hemodynamics has become an useful tool to evaluate the behaviour of blood flowing through natural vessels or artificial prosthesis and an accurate knowledge of the local flow field is important to prevent possible damage to the blood and to the vessel. Many challenging aspects are involved in this study: the deformability of the elastic vessel wall, the use of a reliable non-newtonian model for blood, the effect of curvature, tapering, variation of the artery section and artery bifurcations. The aim of this symposium is to provide an overview of the current status in this area and to build a bridge between mathematical/computational capabilities and biomedical demand.

MSP-169 Appleton Tower, Lecture Theatre 5

The Mortar Element Method for High Order Discretizations: The Mortar Spectral Element Method, Other High Order Discretizations with Mortars I

(see also Part II, MSP-170, p. 108)

Organisers: BERNARDI, Christine (CNRS and Université Pierre et Marie Curie, Paris, France)
BEN BELGACEM, Faker (MIP, Université Paul Sabatier, Toulouse, France)

The mortar element method is a domain decomposition technique which allows for working on general decompositions of the domain without conformity restrictions and also for using different discretizations of variational type on the subdomains. The aim of this minisymposium is to present the recent developments and applications of the mortar method for high order discretizations. Half of the talks are devoted to the spectral element methods, where the mortar technique is a key way for handling complex geometries. The other talks concern recent extensions to other types of discretizations, such as wavelets or $h-p$ version of finite elements.

MSP-190 Appleton Tower, Lecture Theatre 4

Spline Collocation Methods for Partial Differential Equations

Organisers: FAIRWEATHER, Graeme (Colorado School of Mines, USA)
BIALECKI, Bernard (Colorado School of Mines, USA)

Over the past twenty five years, spline collocation methods have evolved as valuable techniques for the efficient solution of partial (as well as ordinary) differential equations. Their efficacy is due in part to their high global accuracy and superconvergence properties, and ease of implementation. Presentations in this session describe recent advances in the development, analysis and implementation of spline collocation methods, including direct and iterative methods for the solution of spline collocation equations for elliptic problems, and alternating direction implicit spline collocation methods for initial-boundary value problems. Both orthogonal spline collocation and modified nodal spline collocation methods are discussed.

BIALECKI, Bernard (Colorado School of Mines, USA) *An orthogonal spline collocation alternating-direction implicit method for nonlinear parabolic problems on rectangular polygons* (p. 174)
CHRISTARA, Christina (Department of Computer Science, University of Toronto, Canada) *High-performance spline collocation methods for elliptic PDEs* (p. 174)
KARAGEORGHIS, Andreas (Department of Mathematics and Statistics, University of Cyprus, Cyprus) *Modified nodal spline collocation methods for elliptic boundary value problems* (p. 174)
KIM, Sangdong (Kyungpook Nat'l university, Taegu, Korea) *Preconditioning polynomial spline collocation method to elliptic equations* (p. 174)
SUN, Weiwei (City University of Hong Kong, Hong Kong) *Fast algorithms for solving high-order spline collocation discrete systems* (p. 174)

MSP-195 William Robertson Building, Seminar Room 2

Phase Field Models and Prediction of Micro-Morphological Changes in Alloys I

(see also Part II, MSP-196, p. 109)

Organisers: MULLER, Wolfgang H (Department of Mechanical & Chemical Engineering, Heriot-Watt University, UK)
DREYER, Wolfgang (Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany)

Many industrially relevant materials show micro-morpholocical changes as a consequence of their daily use, which directly influences their current material properties, reliability and lifetime. Examples of such materials are Ni-based single-crystal super-alloys which are used as turbine material, bio-compatible ceramics, which show an extremely high toughness, or tin-lead solders, which are used in micro-electronics applications. For a quantitative understanding of the influence of the factors which primarily lead to morphological changes it is necessary to develop physical theories which allow to compute the local concentrations of the various alloys as they develop over time as a consequence of internal as well as external thermo-mechanical stresses. From an engineering point of view the theories of the Cahn-Hilliard-Allan type are particularly suited to solve such problems. They only require physical parameters that can directly be linked to experiments, such as free energy curves, surface tensions and lattice constants. However, the engineering need is to find solutions of complex 2D and 3D initial boundary value problems and, due to time constraints, a rigorous mathematical treatment is hardly ever performed. On the other hand mathematicians concentrate on simplified forms of these equations (often in 1D) in order to be able to prove uniqueness and numerical stability. The objective of the symposium is to provide a forum, where mathematicians and engineers can meet to understand their concepts and needs in order to bridge the gap between practical requirements and stringent theoretical considerations.

MULLER, Wolfgang H (Department of Mechanical & Chemical Engineering, Heriot-Watt University, UK) *Trends in modelling micromorphologies of solids - a review (Part I)* (p. 179)
DREYER, Wolfgang (Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany) *Trends in modelling micromorphologies of solids, Part II: Statistical mechanics and molecular dynamics of tin/lead alloys* (p. 178)
NIETHAMMER, Barbara (University of Bonn, Germany) *Mathematics of the Lifshitz-Slyozov-Wagner theory of Ostwald ripening* (p. 179)
BLOWEY, James F (University of Durham, Department of Mathematical Sciences, UK) *Mathematical and numerical analysis of some models for phase separation of N-component alloys* (p. 178)

MSP-199 David Hume Tower, Room 3.01

Java for Computational Science and Engineering I

(see also Part II, MSP-244, p. 111)

Organisers: BOISVERT, Ronald F (National Institute of Standards and Technology, USA)
TREFETHEN, Anne E (The Numerical Algorithms Group, Ltd., UK)

Java has become a household word in the age of the World Wide Web. Behind all the press releases is a surprisingly capable general-purpose programming language and environment which is beginning to be applied to serious scientific applications. What are the advantages and disadvantages of using Java in these contexts? This minisymposium will focus on the use of the Java programming language for numerical and scientific computing. Java-based simulation and data-intensive applications and visualization tools will be presented, and on-going efforts to improve the language and develop standards for numerical computing will be discussed.

BOISVERT, Ronald F (National Institute of Standards and Technology, USA) *Java for numerical computing* (p. 181)
FERNANDEZ, Victor (Sun Microsystems Inc, USA) *A Java visualization and steering interface for the sun scalable scientific subroutine library (Sun S3L)* (p. 182)
RANA, Omer F (Cardiff University, UK) *Performance issues in the use of Java for distributed scientific applications* (p. 183)
WEIDMANN, Matthias (Technical University Munich, Germany) *Pure Java computational fluid dynamics: Collaborative engineering with a real-world application* (p. 183)

MSP-202 Appleton Tower, Seminar Room 6

Spectral Problems in Differential Equations

Organiser: MARLETTA, Marco (University of Leicester, UK)

This minisymposium will cover recent work on spectral problems in differential equations, including: - theoretical results for pencils of operators (i.e. eigenproblems of the form $Ny = \lambda Py$, where N and P are differential operators); - numerical methods for higher order problems; - non-selfadjoint problems; - problems which are nonlinear in the spectral parameter. Problems such as these arise in numerous applications, including fluid dynamics, elasticity and quantum mechanics.

MENNICKEN, Reinhard (University of Regensburg, Germany) *Spectral theory for systems of singular differential operators of mixed order and applications*
TRETTER, Christiane (University of Regensburg, Germany) *Boundary eigenvalue problems of Orr-Sommerfeld type* (p. 185)
HINZ, Andreas M (Technical University Munich, Germany) *Radially symmetric Schrödinger operators* (p. 185)
MARLETTA, Marco (University of Leicester, UK) *Non-selfadjoint ODE eigenproblems* (p. 185)

MSP-205 William Robertson Building, Seminar Room 4

Methods of Dimension Reduction I

(see also Part II, MSP-206, p. 109)

Organisers: KREUZER, Edwin (Technische Universitaet Hamburg-Harburg, Germany)
TROGER, Hans (Technical University Vienna, Austria)

From experiments and also from computer simulation of dynamical systems it is well known that for many dynamic phenomena in physics or engineering which are modelled by high dimensional or even infinite dimensional dynamical systems the asymptotic behavior can be very accurately described by replacing the original high dimensional system by a low dimensional system represented only by so-called essential variables. Such a dimension reduction of a dynamical system turns out to be central, both for a qualitative and quantitative understanding of its behavior. Besides mathematically well established standard methods like Center Manifold theory which, however, have certain limits concerning their applicability other approaches like Proper Orthogonal Decomposition or Inertial Manifold theory have been proposed and applied to practical engineering problems recently. The aim of this Minisymposium is twofold. First, to give an overview on various possibilities concerning the reduction of the dimension of high dimensional or even infinite dimensional dynamical systems to low dimensional systems which still possess all essential features of the original system. Second, to demonstrate by means of selected applications taken from physics or practical engineering problems the efficiency and accuracy of the proposed methods.

HOLMES, Philip J (Princeton University, USA) *The proper orthogonal decomposition and dimension reduction* (p. 187)
TITI, Edriss S (University of California, Irvine, USA) *Rigorous estimates for the number of degrees of freedom in dissipative systems and for the small scales in turbulent flows* (p. 188)
BLOCH, Tony (University Of Michigan, Ann Arbor, USA) *Reduction of constrained and interconnected mechanical systems* (p. 187)
KIRBY, Michael (Colorado State University, Ft Collins, USA) *Dimensionality reduction via well-conditioned mappings* (p. 187)

MSP-207
Warranty Modelling and Data Analysis

Management School, Lecture Theatre 5

Organisers: JACK, Nat (University of Abertay, Dundee, UK)
SCARF, Philip A (University of Salford, UK)

Product warranty studies are important to both manufacturers and buyers. Manufacturers need to know the costs of offering specific warranties, how to determine optimal servicing strategies, and how to collect claims data and perform proper analyses. Buyers have to choose between products with different characteristics and warranty terms and also have to decide whether optional warranties are worth the additional cost. The speakers at this mini-symposium are all leading researchers in the mathematical and statistical aspects of warranty analysis. Their talks will emphasise the importance of analytical modelling in tackling real-life problems.

MURTHY, D N P (University of Queensland, Australia) *Product warranty and mathematical modelling* (p. 189)
BLISCHKE, Wallace R (University of Southern California, Los Angeles, USA) *Cost analysis of warranties* (p. 189)
BROMBACHER, Aarnout (University of Technology, Eindhoven) *Developing Test Strategies For Time-Driven Product Creation*

MSP-211
Challenging Problems in Large-Scale Computing

Management School, Lecture Theatre 4

Organisers: KAPER, Hans G (Argonne National Laboratory, USA)
GARBEY, Marc (Université Claude Bernard - Lyon I, France)

We propose to address several issues in large-scale scientific computing. The issues have come up in computational fluid dynamics, combustion modeling, and sound synthesis, and offer an interesting array of challenging problems in scientific computing. The speakers will discuss modeling issues, numerical methods, and computing strategies, and illustrate their results with videos and sound clips.

GARBEY, Marc (Center for the Development of Parallel Scientific Computing, Univ-Lyon1, France) *A new algorithm for the parallel computation of Navier-Stokes and reaction-diffusion systems* (p. 189)
STEWART, D Scott (Department of Theoretical and Applied Mechanics, University of Illinois, USA) *Approximation of detonation dyanmics by the compressible Euler equations with singular source terms* (p. 190)
TROMEUR DERVOUT, Damien (Université Claude Bernard - Lyon I, France) *Domain decomposition with local Fourier basis methodology applied to the Navier-Stokes and reaction-diffusion systems* (p. 190)
FISCHER, Paul F (Argonne National Laboratory, Argonne IL, USA) *Robust high-order algorithms for unsteady flow applications* (p. 189)
KAPER, Hans G (Argonne National Laboratory, USA) *Sound synthesis for scientific sonification* (p. 190)

MSP-217
Differential Geometric Methods in Control and Design

Adam Ferguson Building, Room 10

Organisers: CAGNOL, John (Ecole des Mines de Paris, France)
ZOLÉSIO, Jean-Paul (Ecole des Mines de Paris and CNRS-INLN, France)

Over the past few years differential geometric methods have been introduced in the control of partial differential equations with variable coefficients. Good choices of variables can locally reduce the complexity of the equations by placing the original system on an appropriate manifold. At the same time new approaches have been developed for the modeling and control of differential equations on submanifolds of the Euclidean space. The objective is to bring together in a very timely way the two trends and investigate the their combined impact on control and geometric design.

CAGNOL, John (Ecole des Mines de Paris, France) *Shape control for hyperbolic problems via the second order shape derivative* (p. 194)
DELFOUR, Michel C (Centre de Recherches Mathématiques, Canada) *New intrinsic differential geometric methods in control and design: overview and examples* (p. 194)
TRIGGIANI, Roberto (University of Virginia, USA) *Riemann geometric methods in control theory for partial differential equations* (p. 194)
ZOLÉSIO, Jean-Paul (Ecole des Mines de Paris and CNRS, France) *Intrinsic geometry and variational principle in the Euler equation* (p. 194)

MSP-218 Appleton Tower, Seminar Room 8
Industrial Image Processing, Mathematics for Software Companies

Organisers: MAASS, Peter (University of Potsdam, Potsdam, Germany)
ENGL, Heinz W (Johannes-Kepler-Universitaet, Linz, Austria)

Over the last few years several 'mathematical' software companies have proved that the transition from mathematical research to industrial products can be a fruitful process, both for the involved universities and companies. The mathematical theory needed for these developments ranges from nonlinear PDE's and wavelet analysis to stochastic inverse problems. The talks in this minisymposium will be given by pairs from industry and the cooperating universities. They will highlight the mathematical background, the process of interaction and the resulting products.

BINDER, Andreas (MathConsult GmbH; Johannes Kepler University, Linz, Austria) *Mathematical modelling and numerical simulation of a process in ironmaking* (p. 194)
STARK, Hans-Georg (FH Schweinfurt and TecMath GmbH, Kaiserslautern, Germany) *Towards multimedia archives for broadcasting applications* (p. 195)
TALBOT, R (SIMULOG Inc., Paris, France) *Industrial mathematics*
MAASS, Peter (University of Potsdam, Math. Department and WiSenT GmbH, Potsdam, Germany) *Mathematics for automated archiving systems, the art of character recognition* (p. 194)

11.00 – 13.00 Contributed Presentations: Lectures

C-11 Adam Ferguson Building, Room 13
Numerical Methods in Differential Equations III
Chair(s): KEYES; ROLDAN

11.00–11.15 USHIJIMA, Takeo K (Graduate School of Mathematical Sciences, University of Tokyo, Japan) *Convergence of a crystalline algorithm for the generalized curvature flow* (p. 320)
11.15–11.30 USHIJIMA, Teruo (University of Electro-Communications, Tokyo, Japan) *Finite element determination of 2D perfect fluid around a wing* (p. 320)
11.30–11.45 KEYES, David E (Old Dominion University and ICASE (NASA Langley Res. Ctr.), USA) *Parallel implicit methods for CFD and diffusive radiation transport* (p. 277)
11.45–12.00 STEFANICA, Dan (Courant Institute of Mathematical Sciences, USA) *Domain decomposition methods for mortar finite elements* (p. 313)
12.00–12.15 YAZAKI, Shigetoshi (Graduate School of Mathematical Sciences, University of Tokyo, Japan) *On the crystalline algorithm for the curvature-dependent motion* (p. 330)
12.15–12.30 ARULIAH, Dhavide A (University of British Columbia, Canada) *A method for the forward modelling of 3D electromagnetic quasi-static problems* (p. 237)
12.30–12.45 ROLDAN, Teo (Universidad Publica de Navarra, Spain) *Irk methods for index-2 DAE: Starting algorithms* (p. 304)
12.45–13.00 ROOSE, Dirk (Dept. of Computer Science, K U Leuven, Belgium) *Travelling pulse solutions and their stability in anisotropic media* (p. 304)

C-12 Adam Ferguson Building, Room 14

Fluid Mechanics III

Chair(s): PEGO; CRAIK

11.00–11.15 PUGH, Mary C (Math Department, University of Pennsylvania, USA) *Long-wave instabilities in thin film equations - blow-up, saturation, and steady-states* (p. 300)
11.15–11.30 MARTEL, Carlos (ETSI Aeronáuticos, Universidad Politécnica de Madrid, Spain) *Parametrically forced counterpropagating waves in weakly dissipative systems* (p. 286)
11.30–11.45 PEGO, Robert L (University of Maryland, College Park, USA) *Spatial wave dynamics of traveling wave surfaces* (p. 297)
11.45–12.00 SUGIMOTO, Takeshi (Kanagawa University, Japan) *Stability and self-organization of formation flight* (p. 315)
12.00–12.15 TASSO, Henri (Max-Planck-Institut fuer Plasmaphysik, Germany) *On Lyapunov stability of dissipative mechanical systems* (p. 317)
12.15–12.30 CHANG, Chien-Cheng (Institute of Applied Mechanics, National Taiwan University, Taipei, Taiwan) *Numerical study of flow about a finite body by a three-dimensional hybrid vortex method* (p. 246)
12.30–12.45 CRAIK, Alex D D (University of St Andrews, UK) *Second-harmonic resonance with Faraday excitation: Degenerate "bouncing" solutions* (p. 250)
12.45–13.00 KHAN, Winston (UPR-Mayaguez, Puerto Rico, USA) *Extension of Danckwert's surface renewal theory to all interfacial conditions* (p. 277)

C-13 Adam Ferguson Building, Room 17

Solid Mechanics

Chair(s): MOLOKOV; MORRO

11.00–11.15 CAVIGLIA, Giacomo (University of Genoa, Italy) *Existence and uniqueness in the reflection-transmission process* (p. 246)
11.15–11.30 POBEDRIA, Boris E (Moscow State University, Russia) *The problems of computational mechanics of composites* (p. 298)
11.30–11.45 MOLOKOV, Sergei (Coventry University, UK) *Propagation of stress waves in wires carrying electric current* (p. 289)
11.45–12.00 TWEED, John (Old Dominion University, USA) *Stress intensification due to an edge crack in an anisotropic elastic solid* (p. 319)
12.00–12.15 MELROSE, Gordon (Old Dominion University, Norfolk, USA) *The bending problem for a simply supported strip with internal supports* (p. 287)
12.15–12.30 MONTANARO, Adriano (Dipartimento di Metodi e Modelli Matematici per le Scienze Applicate, University of Padua, Italy) *On small-amplitude waves in internally constrained and prestressed linearly elastic materials* (p. 289)
12.30–12.45 MORRO, Angelo (University of Genoa, Italy) *Reflection and transmission through a stratified slab* (p. 289)
12.45–13.00 BUELLESBACH, Juergen (Universitaet der Bundeswehr Muenchen, Germany) *On the influence of geometrical imperfections on stability behaviour of shell constructions* (p. 244)

C-14 Adam Ferguson Building, Room 18

Asymptotics and Control Theory

Chair(s): GROSS; DEBNATH

11.00–11.15 KAY, Anthony (Loughborough University, UK) *Finite-time blow-up in an inviscid buoyancy-driven flow* (p. 276)
11.15–11.30 VARGAS, C Arturo (IIMAS-UNAM, Mexico) *Thermistor effects on tuned circuit* (p. 321)
11.30–11.45 GROSS, Laura K (The University of Akron, USA) *Stability of uniform bend Fréedericksz configuration in nematic liquid crystals* (p. 265)
11.45–12.00 KUMAGAI, Teruo (Science University of Tokyo, Japan) *Revaluation of Oseen's approximation for prediction of rotating motions of a cluster of spheres in fluid at low Reynolds numbers* (p. 281)
12.00–12.15 IRAGO, Hipólito (Dpto. Matemática Aplicada, Universidade de Santiago de Compostela, Spain) *Convergence of high frequency modes in thin rods* (p. 272)
12.15–12.30 DELGADO-ROMERO, Juan J D (Instituto Tecnológico de Morelia, México) *Robust analysis of physical systems: Application conditions* (p. 253)
12.30–12.45 DEBNATH, Joyati (Winona State University, USA) *Associated pairs via an automated system* (p. 253)
12.45–13.00 TOKARZEWSKI, Jerzy (Industrial Institute of Motorization, Poland) *Dynamical interpretation of invariant zeros in degenerate Mimo LTI systems* (p. 317)

C-32 Appleton Tower, Room 2.A2
Financial Mathematics and Probability
Chair(s): GRANDITS; KRIVONOZHKO

11.00–11.15 FIBICH, Gadi (Tel-Aviv University, Israel) *Dynamic optimal pricing decisions in the presence of reference-price effects* (p. 259)
11.15–11.30 WYATT, Katherine (Logic Based Systems Lab, Brooklyn College, City University of New York, USA) *Maximizing hedge effectiveness under* FASB 133 *accounting standards* (p. 327)
11.30–11.45 GRANDITS, Peter (Statistical Laboratory, University Cambridge, UK) *Leland's approach to option pricing: the evolution of a discontinuity* (p. 264)
11.45–12.00 VORONIN, Albert N (Space Research Institute, Ukraine) *Multi-objective design of combined effect of biologically active substances* (p. 324)
12.00–12.15 YÚNUSI, Mahmadyusuf K (Tajik State National University, Dushanbe, Tajikistan) *Workers potential function and its applications* (p. 330)
12.15–12.30 ANGULO, Oscar (Universidad de Valladolid, Spain) *A characteristic method for nonlinear size-structured population equations* (p. 236)
12.30–12.45 KRIVONOZHKO, Vladimir Egorovich (Institute For Systems Analysis, Russia) *The optimization models to efficiency analysis of the complex systems* (p. 281)
12.45–13.00 LIN, Jen-Jen (Dept. of Statistics, Ming Chuan University, Taipei, Taiwan) *A new algorithm of independent component analysis with application* (p. 284)

C-39 William Robertson Building, Seminar Room 3
Signal and Image Analysis
Chair(s): HORNE; FAVELLA

11.00–11.15 LI, Shidong (San Francisco State University, USA) *Subspace signal expansions with off-the-space sequences and applications* (p. 283)
11.15–11.30 TURNER, Peter R (US Naval Academy, USA) *Image and moving object identification in computer vision* (p. 319)
11.30–11.45 HORNE, Rudy L (University of Colorado USA) *A comparison between lumped and distributed filter models in WDM soliton systems* (p. 271)
11.45–12.00 ZHELUDEV, Valery A (School of Mathematical Sciences, Tel Aviv University, Israel) *On classification and recognition of acoustic signals by wavelet methods* (p. 331)
12.00–12.15 TOPIWALA, Diven (Dept of Mathematics, De Montfort University, UK) *The phase retrieval algorithm: A dynamical systems approach* (p. 318)
12.15–12.30 DONATINI, Pietro (University of Bologna, Italy) *Natural size distances for comparison of shapes* (p. 255)
12.30–12.45 FAVELLA, Luigi (Department of Physics, University of Torino, Torino, Italy) *Mathematical model of Eigenfunctions for image Loève-Karhunen recostruction* (p. 258)
12.45–13.00 BRÉE, David S (University of Manchester, UK) *Most-perfect magic squares* (p. 243)

C-42 Appleton Tower, Room 2D
Partial Differential Equations and Asymptotics
Chair(s): RICHARDSON; BROADBRIDGE

11.00–11.15 LOZIER, Daniel W (National Institute of Standards and Technology, USA) *The DLMF project: a new initiative in special functions* (p. 284)
11.15–11.30 MOURA NETO, Francisco D (Instituto Politécnico, Universidade do Estado do Rio de Janeiro, Brazil) *Heterogeneous porous medium and Darcy's law* (p. 290)
11.30–11.45 RICHARDSON, Giles W (Laboratoire Phys. Stat, Ecole Normale Superieure, France) *Bifurcations in the Little-Parks experiment* (p. 303)
11.45–12.00 DOMNYTSKY, Vladymyr (State Kiev University, Ukraine) *On the asymtotic solution of a system of integro-differential equations with lagging argument* (p. 254)
12.00–12.15 CHEREDNICHENKO, Kirill D (Department of Mathematical Sciences, University of Bath) *On derivation of the "higher order" effects in the overall behaviour of heterogeneous media from microstructure* (p. 247)
12.15–12.30 TUREK, Zbigniew (ZTUREK Research-Scientific Institute, Warsaw, Poland) *Another alternative approach of getting solutions to some PDEs* (p. 319)
12.30–12.45 BROADBRIDGE, Philip (University of Wollongong, Australia) *Symmetry analysis of equations of solute transport in soil* (p. 244)
12.45–13.00 CHERNIHA, Roman M (Institute of Mathematics, Ukrainian Academy of Science, Kyiv, Ukraine) *New exact solutions of non-linear reaction-diffusion equations arising in population dynamics* (p. 247)

C-47 David Hume Tower, Room 3.18

Medicine and Biology

Chair(s): JOHNSTON; WAN

11.00–11.15 DE PILLIS, L G (Department of Mathematics, Harvey Mudd College, Claremont, USA) *Modeling cancer tumor growth with immune resistance and an optimal control approach to treatment* (p. 252)

11.15–11.30 KIM, Mi-Young (Dept of Math, Yonsei University, Seoul, Korea) *Characteristic Galerkin finite element methods for diffusion epidemic models* (p. 278)

11.30–11.45 JOHNSTON, Clifton Reed (University of Calgary, Canada) *Solitary wave solution for axially and radially deforming arteries* (p. 274)

11.45–12.00 KOZYREVA, Ekaterina (1, 1st Dorozhny pr., Moscow 113545, Russia) *Elastic rod model of 3D structure of RNA* (p. 280)

12.00–12.15 FDEZ-GARCÍA, José R (Depto. Matemática Aplicada, Universidade de Santiago de Compsotela, Spain) *A finite element contact model for the reduction of Mandibular fractures* (p. 258)

12.15–12.30 DUBINSKY, Andrej Yu (Keldysh Institute of Applied Mathematics, Moscow, Russia) *Mathematical modelling of electron transport and proton transfer in chloroplasts* (p. 255)

12.30–12.45 WAN, Honghui (Computational Biology Branch, National Center For Biotechnology Information, Bethesda, USA) *Longest chains in the composite lattices of integer partitions ordered by majorization* (p. 325)

12.45–13.00 No talk

11.00 – 13.00 Contributed Presentations: Posters

P-2 David Hume Tower, Lower Foyer

Posters II

ICIAM 99
5-9 July 1999

Wednesday, 7 July, Afternoon Session
Overview

	14.00 – 14.45 Plenary Lectures	
	A JAMESON, *Advances in Computional Fluid Dynamics*	MH
	A M LINAN, *The Role of Multiple Scales in Combustion Theory*	GS
	14.55 – 15.40 Plenary Lectures	
	H BERESTYCKI, *Some Nonlinear PDE's in Combustion Theory*	GS
	Olivier PIRONNEAU, *Domain Decomposition and Fast Parallel Solvers for the Navier-Stokes Equations*	MH
	16.00 – 18.00 Mini-Symposia	
MSP-024	New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials VI	WRB-11
MSP-043	Mathematical Aspects of Finance	WRB-8
MSP-049	Mathematical Modeling of Electromagnetics III	DHT-N
MSP-056	Modelling and Analysis for Optical Communications; Beam and Pulse Propagation; Dispersion-Management II	WRB-10
MSP-060	Mathematical Methods in Solid Mechanics II	DHT-C
MSP-064	Mathematics Applied to Quantum Chemistry: Theoretical, Computational and Experimental Aspects II	DHT-4.01
MSP-070	Applications of Optimal Mass Transfer Problems to Meteorology and Oceanography	DHT-S
MSP-117	New Developments in Shape Optimization	AFB-10
MSP-118	Computational Aspects of Distributed Parameter Estimation in Applications Involving PDEs	AT-2B
MSP-120	Large Numbers of Students of Mathematics: How to Assess II	AT-3
MSP-121	Characteristic-Based Accurate Simulations to Advection-Dominated Porous Media Flows	AT-1
MSP-124	Recent Advances on Splitting Methods for Partial Differential Equations in the Honour of Gilbert Strang	AT-4
MSP-131	Advances in Numerical Methods for Wave Propagation II	DHT-B
MSP-132	Kinetic and Relaxation Methods for Hyperbolic Conservation Laws	AT-6
MSP-144	Mathematical Problems in Circuit Simulation	AT-8
MSP-157	Multiphase Flows in Porous Media	MS-1
MSP-163	Parallel Software for Sparse Matrices and Applications	MS-3
MSP-170	The Mortar Element Method for High Order Discretizations: The Mortar Spectral Element Method, Other High Order Discretizations with Mortars II	AT-5
MSP-196	Phase Field Models and Prediction of Micro-Morphological Changes in Alloys II	WRB-2
MSP-206	Methods of Dimension Reduction II	WRB-4
MSP-224	High Accuracy Solutions of Partial Differential Equations	MS-4
MSP-227	Diffusion and Convection in Random Media	MS-5
MSP-231	Models, Analysis and Algorithms for Superconductivity II	WRB-9
MSP-236	MHD-IV: Liquid-Metal Flows at High Hartmann and Reynolds Numbers	AT-2
MSP-237	Multigrid Methods for Optimization Problems	DHT-4.18
MSP-244	Java for Computational Science and Engineering II	DHT-3.01
MSP-252	Mathematical Modelling and Computational Aspects in Blood Flow II	WRB-1
	16.00 – 18.00 Contributed Presentations: Lectures	
C-15	Numerical Methods in Differential Equations IV	AFB-13

C-16	Fluid Mechanics IV	AFB-14
C-17	Analysis	AFB-17
C-25	Computational Fluid and Solid Mechanics II	AFB-18
C-33	Numerical Linear Algebra and Discrete Mathematics	AT-2.A2
C-36	Simulation, Neural Networks, Geometric Modelling, Linear and Nonlinear Programming	AT-2D
C-40	Optimization II	WRB-3
	16.00 – 18.00 Contributed Presentations: Posters	
	This is the continuation of the morning session, see p. 96	

Also this evening		
17.00 - 19.00	**Mathematics and the Law Symposium**, see p. 222	Royal Society of Edinburgh
20.00 – 24.00	**Scottish Evening**, see p. 220	Teviot Row House

Wednesday, 7 July, Afternoon Session
Details

14.00 – 14.45 Plenary Lectures

Plenary Lecture — McEwan Hall

A JAMESON (Princeton University, USA)

Advances in Computional Fluid Dynamics

Chair: J C R HUNT (Cambridge University, UK)

Plenary Lecture — George Square Lecture Theatre

A M LINAN (Universidad Politecnico Madrid, Spain)

The Role of Multiple Scales in Combustion Theory

Chair: A A LACEY (Heriot-Watt University, UK)

14.55 – 15.40 Plenary Lectures

Plenary Lecture George Square Lecture Theatre

H BERESTYCKI (University of Paris VI, France)

Some Nonlinear PDE's in Combustion Theory

Chair: A A LACEY (Heriot-Watt University, UK)

Nonlinear partial differential equations of various kinds abound in the modelling of combustion phenomena. From a mathematical viewpoint, they often lead to challenging problems and new developments.
In view of the complexity of an exhaustive description, it is customary to study partial systems which emphasize some specific aspects. Indeed, the modelling of reactive flows involves fluid dynamics, chemical kinetics, diffusion, heat conduction and transport mechanisms.
The objective of this presentation is to review the progress and open problems in the study of several such systems set in the framework of the thermo-diffusive model. There, the underlying velocity field of the fluid is taken as prescribed and the equations have the form of reaction diffusion and convection systems. Flames are thought of as travelling front like solutions. Besides distributed equations, it is also classical to consider the limit of vanishing flame width. Through a singular limit, one is then led to free boundary problems in which flames are concentrated on surfaces.
Both types of models are discussed. The propagation of flames is considered in several geometrical settings : in tubes, in space, with various types of velocity fields, Bunsen burner type settings and flames under the influence of gravity.
One of the main themes is to understand how the existence and shapes of flames as well as the speed at which they propagate are related to the geometry and to the amplitude and frequency of oscillations of the velocity field. These considerations are relevant for models of turbulent combustion. A related topic is the influence of stirring on the limits of thermal explosions.

Plenary Lecture McEwan Hall

Olivier PIRONNEAU (University of Paris VI, France)

Domain Decomposition and Fast Parallel Solvers for the Navier-Stokes Equations

Chair: J C R HUNT (Cambridge University, UK)

Domain decomposition is a straightforward approach to parallelization of Partial Differential equations solvers. But the following difficulties must be solved:
- - Consistency of the approximations, whether the mesh match at the domain intersections with or without overlaping
- - Convergence and efficiency of the iteration schemes such as Schwarz algorithm, Chebichev or conjugate gradient iterations on the Schur complement problem. - - Implementation with PVM/MPI or others.
This talk will discuss these issues for the Navier-Stokes equations in 2 and 3 dimensions. Numerical results with several million points on unstructured mesh obtained by our team will also be discussed.

16.00 – 18.00 Mini-Symposia

MSP-024 William Robertson Building, Seminar Room 11

New Developments in Partial Differential Equations, in the Calculus of Variations, in Simulation and Applications to Materials VI

(see also Part I, MSP-019, p. 13; Part II, MSP-020, p. 29; Part III, MSP-021, p. 47; Part IV, MSP-022, p. 64; Part V, MSP-023, p. 82)

Organisers: FONSECA, Irene (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)
KINDERLEHRER, David (Center for Nonlinear Analysis, Carnegie Mellon University, Pittsburgh, USA)

ORTIZ, Michael (Graduate Aeronautical Laboratories, California Institute of Technology, USA) *Kinetic roughening and coarsening in thin films* (p. 34)
DESIMONE, Antonio (MPI for Mathematic in the Sciences) *Energetics of fine domains* (p. 32)
OTTO, Felix (University of California at Santa Barbara, USA) *Thin film ferromagnets* (p. 34)
KINDERLEHRER, David (Carnegie Mellon University, Pittsburgh, USA) *Grain boundary energy and evolution* (p. 32)

MSP-043 William Robertson Building, Lecture Theatre 8

Mathematical Aspects of Finance

Organiser: KUSUOKA, Shigeo (University of Tokyo, Japan)

This mini-symposium aims to clarify theoretical and empirical aspects of financial modelling, option pricing and risk management. The topics may include financial time series analysis, efficient numerical computation of high-dimensional or infinite-dimensional integration and optimal stochastic control problems.

KISHIMOTO, Kazuo (University of Tsukuba, Japan) *Spectral properties of the operators which appears in the GARCH(1, 1) model* (p. 50)
SHIRAKAWA, Hiroshi (Tokyo Institute of Technology, Japan) *Financial derivative evaluation by a simple low discrepancy sequence* (p. 51)
KUSUOKA, Shigeo (Graduate School of Mathematical Sciences, University of Tokyo, Japan) *Approximation of expectation on diffusion model in finance* (p. 50)

MSP-049 David Hume Tower, Faculty Room North

Mathematical Modeling of Electromagnetics III

(see also Part I, MSP-047, p. 66; Part II, MSP-048, p. 82)

Organisers: AMMARI, Habib (Ecole Polytechnique, France)
BAO, Gang (University of Florida, USA)

BONNETIER, Eric (Ecole Polytechnique, France) *Optimal design of 2-D periodic diffractive structures* (p. 54)
DOBSON, David C (Texas A&M University, USA) *Numerical modeling of photonic crystals* (p. 54)
SANTOSA, Fadil (Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, USA) *An optimal design problem arising in diffractive optics* (p. 55)
MCLAUGHLIN, Joyce (Rensselaer Polytechnic Institute, USA) *One way electromagnetic waveguide calculations* (p. 54)
SCHMIDT, Gunther (WIAS Berlin, Germany) *Direct and inverse conical diffraction problems* (p. 55)

MSP-056 William Robertson Building, Seminar Room 10

Modelling and Analysis for Optical Communications; Beam and Pulse Propagation; Dispersion-Management II

(see also Part I, MSP-055, p. 83)

Organisers: SANDSTEDE, Björn (Ohio State University, Columbus, USA)
JONES, Christopher K R T (Brown University, Providence, USA)

MSP-060 David Hume Tower, Lecture Theatre C

Mathematical Methods in Solid Mechanics II

(see also Part I, MSP-059, p. 84; Part III, MSP-061, p. 121; Part IV, MSP-062, p. 141)

Organisers: KAPLUNOV, Julius D (Institute for Problems in Mechanics, Russia)
WAN, Frederic Y M (University of California, Irvine, USA)

MSP-064 David Hume Tower, Room 4.01

Mathematics Applied to Quantum Chemistry: Theoretical, Computational and Experimental Aspects II

(see also Part I, MSP-063, p. 84; Part III, MSP-065, p. 121; Part IV, MSP-066, p. 141)

Organiser: LE BRIS, Claude (Ecole Nationale des Ponts et Chaussées, France)

MSP-070 David Hume Tower, Faculty Room South

Applications of Optimal Mass Transfer Problems to Meteorology and Oceanography

Organisers: DOUGLAS, Robert J (University of Reading, UK)
CULLEN, Michael J P (UK Meteorological Office)

Monge (1781) posed the prototype optimal mass transfer problem: given two sets of equal volume, find the optimal volume-preserving mapping between them, where optimality is measured against a cost function. Such problems arise when studying the semigeostrophic equations, which describe certain motions of the atmosphere and provide a mechanism for the modelling of fronts; these discontinuities can be described by singularities of a mapping. Recent research has focussed on regularity theory, and existence of optimal mappings when the sets are replaced by manifolds. The latter is relevant to semigeostrophic theory in spherical geometry. Both numerical work and theory will be discussed.

MSP-117 Adam Ferguson Building, Room 10

New Developments in Shape Optimization

Organisers: SOKOLOWSKI, Jan (Institut Elie Cartan, Université Henri Poincaré, Nancy, France)
PIERRE, Michel (ENS de Cachan, Antenne de Bretagne, Bruz, France)

Shape optimization is a specific area among optimization problems where the main variable is a subset of R^N. It comes out in lots of applications in engineering, mechanics, electromagnetism, material sciences, geometry, etc. It also raises new interesting and challenging mathematical and computational problems. Current research is very active in particular for the development of the numerical computation of shapes and for the analysis of optimal shapes : regularity, geometric properties, sensitivity,... The goal of this mini-symposium is to present some recently developed techniques in the field together with applications. A new notion of "domain derivative", so-called "topological derivative" will be discussed and applied to Laplace and elasticity problems; an original application of shape optimization in electromagnetism will be presented; a geometric study of optimal shapes will be described.

MSP-118 Appleton Tower, Room 2B

Computational Aspects of Distributed Parameter Estimation in Applications Involving PDEs

Organisers: ASCHER, Uri M (Department of Computer Science, University of British Columbia, Vancouver, Canada)
HABER, Eldad (Department of Computer Science, University of British Columbia, Vancouver, Canada)

Many applications in diverse areas such as geophysical exploration and medical imaging involve the reconstruction of parameter functions from noisy observations on solutions of models consisting of PDEs. The usual approaches have been based on direct or indirect integral equation formulations. However, numerical approaches involving the discretized differential equations of the forward model hold the promise of increased efficiency. Such advantage can be gained by exploiting sparsity, multilevel approaches, and improved methods for solving the constrained, nonlinear data fitting problems that arise. This minisymposium will explore such computational methods.

VOGEL, Curtis R (Montana State University, USA) *Multilevel preconditioners for regularized inverse problems* (p. 115)
HANKE, Martin (Fachbereich 17 Mathematik, Johannes-Gutenberg-Universität Mainz, Germany) *A new method in impedance tomography imaging* (p. 115)
TAI, Xue-Cheng (Department of Mathematics, University of Bergen, Norway) *Identification of discontinuous coefficients from elliptic problems using total variation regularization* (p. 115)
HABER, Eldad (University of British Columbia, Canada) *Solution of large scale inverse problems using inexact Krylov-Newton method* (p. 115)

MSP-120 Appleton Tower, Lecture Theatre 3

Large Numbers of Students of Mathematics: How to Assess II

(see also Part I, MSP-119, p. 86)

Organisers: BARRY, Michael DJ (University of Bristol, UK)
SIMS WILLIAMS, Jonathan H (University of Bristol, UK)
SUTHERLAND, Rosamund (University of Bristol, Graduate School of Education, UK)

CLEMENTS, Dick R R (University of Bristol, UK) *Essential mathematical concepts needed by users of computer algebra* (p. 116)
LABORDE, Colette (Laboratoire Leibniz-IMAG, University Joseph Fourier, Grenoble, France) *Core geometrical knowledge for using the modelling power of geometry with Cabri-geometry* (p. 116)
MUSTOE, Leslie R (Loughborough University, UK) *How far should the residual core of mathematics be affected by the computer?* (p. 117)
CROFT, Anthony C (Loughborough University, UK) *A residual mathematical core for the incorporated engineer* (p. 116)
SUTHERLAND, Rosamund (University of Bristol, Graduate School of Education, UK) *School algebra and the symbol sense of the adult mathematician* (p. 117)

MSP-121 Appleton Tower, Lecture Theatre 1

Characteristic-Based Accurate Simulations to Advection-Dominated Porous Media Flows

Organisers: WANG, Hong (University of South Carolina, Columbia, South Carolina, USA)
LYONS, Stephen L (Mobil Technology Company, Dallas, Texas, USA)

The mathematical models for describing reservoir simulation, environmental fluid flows, and many other applications often lead to coupled systems of advection-dominated PDEs and constraining equations. Their numerical treatment presents severe difficulties. Conventional finite difference or finite element methods generate numerical solutions with severe oscillations. Various upwinding-based improvements tend to introduce excessive numerical dispersion and restrict the time step size, while characteristic-based methods have difficulty in treating general boundary conditions and conserving mass. In this minisymposium, the speakers will present improved numerical methods, based on or related to the ELLAM (Eulerian-Lagrangian Localized Adjoint Method) methodology, which allow large time steps to be used in generating accurate solutions and conserve mass, and their application to reservoir simulation, etc. This minisymposium is intended for audiences from academic and industrial areas, who are interested in advection-diffusion equations, porous media flows.

EWING, Richard E (Institute for Scientific Computation, Texas A&M University, College Station, Texas, USA) *Mathematical modeling and simulation for applications of fluid flow in porous media* (p. 117)
LYONS, Stephen L (Upstream Strategic Research Center, Mobil Technology Company, Texas, USA) *A family of Eulerian-Lagrangian localized adjoint methods for multi-dimensional advection-reaction equations* (p. 118)
QIN, Guan (Upstream Strategic Research Center, Mobil Technology Company, Texas, USA) *Analysis of a compositional model for fluid flow in porous media* (p. 118)
WANG, Hong (University of South Carolina, Columbia, USA) *An ELLAM-MFEM approximation to miscible displacement in porous media* (p. 118)
LIN, Tao (Department of Math., Virginia Tech., USA) *A non-conformal immersed finite element method for interface problems* (p. 117)

MSP-124 Appleton Tower, Lecture Theatre 4
Recent Advances on Splitting Methods for Partial Differential Equations in the Honour of Gilbert Strang

Organiser: KHALIQ, Abdul Q (Western Illinois University, USA)

Splitting methods for partial differential equations have been most frequently studied for several years. The splitting technique of breaking a multi-dimensional problem down into sequence of one dimensional problem has led to the development of so called Alternating Direction Implicit(ADI) methods and Locally One Dimensional (LOD) or fractional step methods. Splitting methods for time dependent PDEs, mainly based on Strang splitting have drawn considerable attention in the literature. Many physical models involve multidimensional PDEs thereby, requiring large scale computation and parallel algorithms. In this mini-symposium recent advances on splitting methods for multidimensional non linear system of PDEs in Computational air pollution modelling, climate related problems, isothermal autocatalytic chemical systems, and in mathematical biology are discussed.

VERWER, Jan G (Center for Mathematics and Computer Science (CWI), The Netherlands) *Results on splitting stiff advection-diffusion-reaction problems* (p. 121)
TEMAM, Roger (Indiana University, Department of Mathematics, USA) *Some remarks on dynamic multilevel methods* (p. 121)
FAIRWEATHER, Graeme (Colorado School of Mines, USA) *Alternating direction implicit orthogonal spline collocation methods for initial/boundary value problems* (p. 120)
KHALIQ, Abdul Q (Western Illinois University, USA) *Parallel LOD methods for reaction-diffusion systems* (p. 120)

MSP-131 David Hume Tower, Lecture Theatre B
Advances in Numerical Methods for Wave Propagation II
(see also Part I, MSP-130, p. 87)

Organiser: HAGSTROM, Thomas (University of New Mexico, New Mexico, USA)

ENGQUIST, Bjorn (KTH, Stockholm, Sweden) *To be announced*
LEVEQUE, Randall J (University of Washington, USA) *High-resolution methods for wave propagation in random media* (p. 126)
ALPERT, Bradley K (National Institute of Standards and Technology, USA) *Rapid evaluation of exact nonreflecting boundary conditions* (p. 125)
RADVOGIN, Yulian B (Keldysh Institute of Applied Mathematics, Moscow, Russia) *The characteristic surfaces method for constructing transparent boundary conditions in the nonseparable variables case* (p. 126)

MSP-132 Appleton Tower, Seminar Room 6

Kinetic and Relaxation Methods for Hyperbolic Conservation Laws

Organiser: NATALINI, Roberto (Istituto per le Applicazioni del Calcolo "M. Picone", Italy)

In recent years many people have started to consider the kinetic approximation of solutions to hyperbolic systems of conservation laws. The starting point is the kinetic approximation of fluid dynamic equations, a classical problem in mathematical physics: as well known the Euler equations can be formally obtained as the fluid dynamical limit of the Boltzmann equation. Important results about classical Boltzmann models as well as discrete velocities models has been obtained during the last decade. Actually there are now many formal and rigorous investigations about the fluid dynamical limit for that models, starting from the celebrated Broadwell model, as long as the limit solutions are smooth. The rigorous theory of kinetic approximations for (entropy) solutions with shocks is more recent and mainly developed when the limit equation is scalar. Some convergence results were given first by using continuous velocities BGK models. Other results have then been established for special systems or partially kinetic approximations. Another interesting approximation, in connection with the very closed framework of lattice Boltzmann and lattice BGK models, is given by the discrete velocities BGK models. These models arise as a generalization of the relaxation approximations and allow the construction of very good schemes with some important features: great simplicity, a very low cost (no need of Riemann solvers or MUSCL–type reconstruction), wide range of applicability, natural formulation for multidimensional problems. There are many recent rigorous results in this direction. The aim of the minisymposium could be to give an account of the problems and developments presented above, also in connection with the applications, by presenting some outstanding recent researches in the field.

AREGBA-DRIOLLET, Denise (Mathématiques Appliquées de Bordeaux, Université Bordeaux 1, France) *Some kinetic type schemes for gas dynamics* (p. 126)
SERRE, Denis A G (Ecole Normale Supérieure de Lyon, France) *The stability and convergence of semi-linear relaxation* (p. 127)
TZAVARAS, Athanasios E (University of Wisconsin-Madison, USA) *On the kinetic formulation of* 2×2 *systems of conservation laws* (p. 127)
GUARGUAGLINI, Francesca R (Dipartimento di Matematica Pura e Applicata, Universitá degli Studi dell'Aquila, Italy) *A kinetic hyperbolic approximation to quasilinear diffusion problems* (p. 127)

MSP-144 Appleton Tower, Seminar Room 8

Mathematical Problems in Circuit Simulation

Organisers: TISCHENDORF, Caren (Lunds Universitet, Sweden)
HIGUERAS, Inmaculada (Universidad Publica de Vavarra, Spain)

The numerical simulation of electrical networks is an important part of the development of integrated circuits. In general, the model equations arising from automatic circuit analysis tools form a differential-algebraic system (DAEs). Unfortunately, these DAEs are often highly nonlinear and not in Hessenberg form, but they provide some structure that should be used by numerical solvers. From the experience with ODEs, we know that the stability properties of the system should also be taken into account and that it would be desirable to maintain them for the numerical solution. On the other hand, some problems occurring during the numerical simulation of network equation systems are often due to inconsistent initial values. In this minisymposium we want to focus onto two problems. Firstly, asymptotic properties and new numerical methods preserving the asymptotic behaviour of solutions are discussed. Secondly, we argue new technics for computing consistent initial values for DAEs arising from circuit simulation.

HIGUERAS, Inmaculada (Universidad Pública de Navarra, Pamplona, Spain) *Numerical methods preserving contractivity* (p. 136)
TISCHENDORF, Caren (Lunds University, Sweden) *Asymptotic properties of DAEs in circuit simulation* (p. 137)
GÜNTHER, Michael (TU Darmstadt, Fachbereich Mathematik, Germany) *PDAE models for electrical network simulation* (p. 136)
LAMOUR, René (Humboldt-University of Berlin, Germany) *Calculation of consistent initial values of lower index DAEs* (p. 136)
SCHEIN, Oliver (Technische Universitaet Darmstadt, Germany) *Stochastic differential algebraic equations for noise in circuits* (p. 136)

MSP-157 Management School, Lecture Theatre 1

Multiphase Flows in Porous Media

Organisers: FASANO, Antonio (Department of Mathematics "U. Dini", Univ. of Florence, Italy)
VAN DUIJN, C J (Center for Mathematics and Computer Science (CWI), The Netherlands)

An important characteristic of multi-phase flow in porous media is capillary pressure between phases. In two-phase flow one often uses the Leverett model, in which the capillary pressure is a unique function of a fluid saturation and inversely proportional to a scaling factor which is related to the absolute permeability. It is shown how this leads to trapping of oil in heterogeneous media. Recently, the Leverett model has been modified to include dynamic effects. This modification involves the time derivative or the saturation. Its mathematical consequences will be discussed. In the steam problem (three phases) it is shown how different forms of capillary pressures carry over in the hyperbolic limit. Capillarity also plays a role in the penetration of wetting fronts through a porous layer with water absorbing granules, giving rise to a complex free boundary problem with a fluid being present in a trapped and in a flowing phase.

VAN DUIJN, C J (Center for Mathematics and Computer Science (CWI), Amsterdam, The Netherlands) *Oil trapping in heterogeneous porous media*
BRUINING, J (Fac. of Civil Engineering and Applied Earth Sciences, Delft, The Netherlands) *Uniqueness conditions in a hyperbolic model for oil recovery by steamdrive*
HULSHOF, Josephus (Mathematical Institute of the Leiden University, The Netherlands) *Mathematical analysis of dynamic capillary pressure* (p. 147)
FASANO, Antonio (Department of Mathematics "U.Dini", Univ. of Florence, Italy) *Flows in porous media with hydrophile granules* (p. 147)

MSP-163 Management School, Lecture Theatre 3

Parallel Software for Sparse Matrices and Applications

Organisers: HAMMARLING, Sven (NAG Ltd, Oxford, UK)
DUFF, Iain S (Rutherford Appleton Laboratory, UK)

In this minisymposium we shall look at two EC funded projects, PARASOL and PINEAPL, that are involved with the development of parallel software for sparse matrix computations, and the use of that software in industrial applications. There will be two talks describing the algoriths and software being developed in the projects, and two talks describing end user applications that are utilising the software.

DUFF, Iain S (Rutherford Appleton Laboratory, UK) *Sparse matrix software in the Parasol project* (p. 152)
DERAKHSHAN, Mishi (NAG Ltd, UK) *The PINEAPL project and the solution of sparse linear equations* (p. 152)
BJØRSTAD, Petter (University of Bergen, Norway) *PARASOL, A parallel library for large sparse linear systems* (p. 151)
D'AMBRA, Pasqua (Center for Research on Parallel Computing and Supercomputers (CPS-CNR), Italy) *When PINEAPL met KIVA: Library usage in industrial applications* (p. 151)

MSP-170 Appleton Tower, Lecture Theatre 5

The Mortar Element Method for High Order Discretizations: The Mortar Spectral Element Method, Other High Order Discretizations with Mortars II

(see also Part I, MSP-169, p. 88)

Organisers: BERNARDI, Christine (CNRS and Université Pierre et Marie Curie, Paris, France)
BEN BELGACEM, Faker (MIP, Université Paul Sabatier, Toulouse, France)

KARAGEORGHIS, Andreas (Department of Mathematics and Statistics, University of Cyprus, Cyprus) *Spectral element methods for problems in circular domains* (p. 158)
BERTOLUZZA, Silvia (Istituto di Analisi Numerica del CNR, Pavia, Italy) *Substructuring techniques for mortar wavelets methods* (p. 158)
PERRIER, Valérie (Laboratoire d'Analyse, Géométrie et Applications, Université Paris Nord, 93430 Villetaneuse, France) *The mortar method in the wavelet context* (p. 159)
SURI, Manil (University of Maryland Baltimore County, USA) *Optimal convergence rates of hp mortar finite element methods* (p. 159)

MSP-196 William Robertson Building, Seminar Room 2

Phase Field Models and Prediction of Micro-Morphological Changes in Alloys II

(see also Part I, MSP-195, p. 89)

Organisers: MULLER, Wolfgang H (Department of Mechanical & Chemical Engineering, Heriot-Watt University, UK)
DREYER, Wolfgang (Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany)

MSP-206 William Robertson Building, Seminar Room 4

Methods of Dimension Reduction II

(see also Part I, MSP-205, p. 90)

Organisers: KREUZER, Edwin (Technische Universitaet Hamburg-Harburg, Germany)
TROGER, Hans (Technical University Vienna, Austria)

MSP-224 Management School, Lecture Theatre 4

High Accuracy Solutions of Partial Differential Equations

Organiser: GUPTA, Murli M (The George Washington University, USA)

This minisymposia would bring together researchers developing high accuracy methods for the solution of partial differential equations of mathematical physics. The emphasis would be on the use of highly efficient computational techniques such as multigrid methods and parallel computation.

MSP-227 Management School, Lecture Theatre 5

Diffusion and Convection in Random Media

Organisers: BOURGEAT, Alain P (UJM-Universite St Etienne, France)
PIATNITSKI, Andrey (P N Lebedev Physical Institute, Russian Academy of Sciences, Russia)

We present some works related to the Scaling up of properties like permeability, conductivity, for randomly heterogeneous media, by mean of Stochastic Homogenization. All problems are modelized, at the Local level, by PDEs with randomly oscillating coefficients, and the Scaling up is intended to give a Global model, associated to purely deterministic PDEs under ergodicity or mixing assumptions. Such problems are important, for instance, in composite material design, in hydrogeology or in oil recovery.

CAMPILLO, Fabien (INRIA/LATP, France) *Homogenization of random difference operators and calculation of effective coefficient* (p. 200)
MICHEL, Julien (Unité de Mathématiques Pures et Appliquées, ENS Lyon, France) *Large deviations estimates in stochastic homogenization* (p. 200)
ABABOU, Rachid (Institut de Mecanique des Fluides de Toulouse, France) *Dispersive transport in random porous media: Particles, fluxes, concentrations, and moment inverse problem* (p. 200)
PIATNITSKI, Andrey (P N Lebedev Physical Institute, Russian Academy of Sciences, Russia) *Averaging of random nonstationary convection-diffusion equations* (p. 201)
BOURGEAT, Alain P (University of St Etienne, France) *Scaling up filtration laws in randomly heterogeneous porous media, by stochastic homogenization* (p. 200)

MSP-231 William Robertson Building, Seminar Room 9

Models, Analysis and Algorithms for Superconductivity II

(see also Part I, MSP-096, p. 85)

Organiser: DU, Qiang (Hong Kong Univ of Science and Technology, Hong Kong, China)

PAN, Xingbin (Zhejiang University, Hangzhou, China) *Surface nucleation of superconductivity* (p. 97)
STYLES, Vanessa (Oxford Brookes University, UK) *Analysis of mean field models of superconducting vortices in one and two-dimensions* (p. 98)
DU, Qiang (Hong Kong University of Science and Technology, Hong Kong, China) *Ginzburg-Landau vortices in d-wave superconductors* (p. 97)
RICHARDSON, Giles W (Ecole Normale Superieure, France) *The bifurcation structure of a thin superconducting loop with small variations in its thickness* (p. 98)

MSP-236 Appleton Tower, Lecture Theatre 2

MHD-IV: Liquid-Metal Flows at High Hartmann and Reynolds Numbers

Organiser: MOLOKOV, Sergei (Coventry University, UK)

Current understanding of magnetohydrodynamic phenomena in strong magnetic fields is largely based on the assumption of the inertialess flow. Most theoretical results have been obtained under this assumption, which strictly speaking is rarely fulfilled in the industrial applications. The aim of the mini-symposium is to discuss the stability, asymptotics and numerical modelling of flows at high Hartmann and Reynolds numbers. Several recent experiments will also be discussed. The mini-symposium is intended for those interested in fundamental issues of liquid-metal magnetohydrodynamics, as well as its applications to fusion and semiconductor crystal growth.

MOLOKOV, Sergei (Coventry University, UK) *Asymptotic structure of parallel layers at high Hartmann and Reynolds number* (p. 206)
BURR, Ulrich (Forschungszentrum Karlsruhe
Institut für Angewandte Thermo- und Fluiddynamik (IATF), Germany) *Turbulent transport of momentum and heat in magnetohydrodynamic rectangular duct flow with strong side wall jets* (p. 206)
LEBOUCHER, Laurent (Centre for numerical modelling and process analysis, University of Greenwich, UK) *Numerical simulation of internal flows at high Hartman and Reynolds numbers* (p. 206)
THESS, Andre (Ilmenau University of Tech., Germany) *Natural convection in a liquid metal heated from above influenced by a magnetic field* (p. 207)
MOREAU, Rene J (Lab MADYLAM, Grenoble, France) *Inertial and 3D effects in MHD boundary layers* (p. 207)

MSP-237 David Hume Tower, Room 4.18
Multigrid Methods for Optimization Problems

Organiser: SCHULZ, Volker H (Interdisciplinary Center for Scientific Computing, University of Heidelberg, Germany)

Multigrid methods provide a well established approach to the numerical solution of large systems of equations derived from discretized differential equations. However, they can be used profitably as well in the context of large-scale optimization problems. These include such diverse areas as inverse problems, shape optimization, layout optimization, optimal control, etc. Multigrid optimization methods are especially useful, if the number of optimization degrees of freedom is in a sense scalable and therefore algorithmical concepts of optimal complexity are needed. The focus of this minisymposium is on the current theoretical and algorithmical status in the field of optimization multigrid methods as well as on recent developments. They are discussed from an application point of view.

MOHR, Marcus (Universität Erlangen–Nürnberg, Germany) *Multigrid methods for inverse bioelectric field problems* (p. 207)
TA'ASAN, Shlomo (Carnegie Mellon University, USA) *One shot multigrid methods for optimization problems* (p. 208)
SCHULZ, Volker H (Interdisciplinary Center for Scientific Computing, University of Heidelberg, Germany) *Simultaneous multigrid SQP methods for optimal control problems* (p. 207)

MSP-244 David Hume Tower, Room 3.01
Java for Computational Science and Engineering II
(see also Part I, MSP-199, p. 90)

Organisers: BOISVERT, Ronald F (National Institute of Standards and Technology, USA)
TREFETHEN, Anne E (The Numerical Algorithms Group, Ltd., UK)

PETZOLD, Linda (Computational Science and Engineering University of California, Santa Barbara, USA) *The JMPL reconfigurable interface for CSE applications development* (p. 182)
MOREIRA, Jose E (IBM, Thomas J Watson Research Center, USA) *Achieving high performance in numerical computing with Java* (p. 182)
CHATTERJEE, Siddhartha (Department of Computer Science, University of North Carolina, Chapel Hill, USA) *High performance numerics in Java: The importance of design* (p. 182)
TREFETHEN, Anne E (The Numerical Algorithms Group, Wilkinson House, Oxford, UK) *The Java library interface* (p. 183)

MSP-252 William Robertson Building, Seminar Room 1
Mathematical Modelling and Computational Aspects in Blood Flow II
(see also Part I, MSP-164, p. 88)

Organiser: PONTRELLI, Giuseppe (IAC-CNR, Viale del Policlinico 137, Rome, Italy)

VENEZIANI, Alessandro (University of Verona, Italy) *Boundary issues for blood flow problems* (p. 153)
NOBILE, Fabio (Departement de Mathematiques, Ecole Polytechnique Federale de Lausanne, Switzerland) *Numerical modelling of fluid-structure interaction problems in hemodynamics* (p. 153)
ZANETTI, Gianluigi (CRS4, Italy) *Viva: The virtual vascular project at CRS4* (p. 154)
DICARLO, Antonio (Università degli Studi "Roma Tre", Italy) *How to model distensible blood vessels* (p. 152)

16.00 – 18.00 Contributed Presentations: Lectures

C-15 Adam Ferguson Building, Room 13
Numerical Methods in Differential Equations IV
Chair(s): XANTHIS; ZHU

16.00–16.15 MICHELETTI, Stefano (Politecnico di Milano, Dipartimento di Matematica "F. Brioschi", Milan, Italy) *Mixed finite volumes for advanced transport models in semiconductors* (p. 287)
16.15–16.30 BOTCHEV, Mike A (CWI, The Netherlands) *A zoom technique for advection schemes in air pollution modelling* (p. 243)
16.30–16.45 XANTHIS, Leonidas S (Centre for Techno-Mathematics & Scientific Computing Laboratory, University of Westminster, London, UK) *Robust iterative methods for thin elastic shells, plates and rods* (p. 328)
16.45–17.00 RAKOWSKY, Natalja (Alfred-Wegener-Institut for Polar and Marine Research, Bremerhaven, Germany) *Schur complement method as parallel elliptic solver in ocean modelling* (p. 302)
17.00–17.15 JALICS, Miklos (Ohio State University, USA) *Steady crystal growth in long ampoules in a vertical Bridgman device* (p. 274)
17.15–17.30 HANSEN, Olaf (Fachbereich Mathematik, Johannes Gutenberg-Universität Mainz, Germany) *Solving numerically the heat equation in unbounded domains in R^2* (p. 267)
17.30–17.45 ZHU, Jianping (Mississippi State University, USA) *On an efficient higher order algorithm for solving partial differential equations* (p. 332)
17.45–18.00 CHEUNG, C W (Department of Mechanical Engineering and Aeronautics, City University, UK) *An asynchronus algorithm for the solution of unsteady subsonic compressible flow* (p. 248)

C-16 Adam Ferguson Building, Room 14
Fluid Mechanics IV
Chair(s): COWLEY; HARPER

16.00–16.15 MASON, David P (University of the Witwatersrand, Johannesburg, South Africa) *On the effect of interfacial tension on slow viscous flow past a spherical liquid drop* (p. 286)
16.15–16.30 BRAUN, Richard J (University of Delaware, USA) *Two phase viscous drop spreading* (p. 243)
16.30–16.45 COWLEY, Stephen J (University of Cambridge, UK) *Spiral-type vortex breakdown on a trailing vortex: A weakly nonlinear marginal instability?* (p. 250)
16.45–17.00 VAN DER SCHRIER, Gerard (Netherlands Institute for Sea Research, The Netherlands) *The diffusionless Lorenz-equations; Shil'nikov bifurcations and reduction to an explicit map* (p. 321)
17.00–17.15 MCKINLEY, Iain S (University of Strathclyde, Glasgow, UK) *Stability of a ridge subject to a jet of air* (p. 287)
17.15–17.30 NICOLAS, Jose Antonio (ETSI Aeronauticos, Universidad Politecnica de Madrid, Spain) *Three-dimensional oscillatory boundary layers* (p. 292)
17.30–17.45 HARPER, John F (Victoria University of Wellington, New Zealand) *Why bubbles rise anomalously slowly in water with air present* (p. 268)
17.45–18.00 IVANOVIĆ, Dečan (Mechanical Engineering Department, University of Montenegro, Podgorica, Yugoslavia) *Unsteady boundary layer of incompressible fluid flow on aerofoil* (p. 273)

C-17 Adam Ferguson Building, Room 17
Analysis
Chair(s): EASTON; ZAFER

16.00–16.15 TKACHENKO, Igor M (Polytechnic University, Valencia, Spain) *Orthogonal polynomials and power moment sets for matrix distributions* (p. 317)
16.15–16.30 SMIRNOV, Georgi (University of Porto, Portugal) *Adsorption integral equation via complex approximation* (p. 311)
16.30–16.45 EASTON, Alan K (Swinburne University of Technology, Australia) *Stability of the selective lumped mass scheme for the shallow water equations* (p. 257)
16.45–17.00 LIMAYE, Balmohan V (Indian Institute of Technology Bombay, India) *Accelerated refinement of approximate eigenelements of integral operators* (p. 284)
17.00–17.15 AVRACHENKOV, Konstantin (University of South Australia, Australia) *Perturbation analysis of reduced resolvents and generalized inverses* (p. 239)
17.15–17.30 SIDOROV, Nikolay A (Irkutsk State University, Russia) *Uniformization of the branching solutions and iterations in nonlinear analysis* (p. 310)
17.30–17.45 ZAFER, Ağacık (Middle East Technical University, Ankara, Turkey) *The controlability of boundary-value problems for quasilinear impulsive systems* (p. 331)
17.45–18.00 VALUSESCU, Ilie (Institute of Mathematics of the Romanian Academy, Romania) *An operatorial view on infinite-variate prediction* (p. 321)

C-25 Adam Ferguson Building, Room 18
Computational Fluid and Solid Mechanics II
Chair(s): NOWAKOWSKI; KERR

16.00–16.15 MARCHENKO, Nikolay A (Keldysh Institute for Applied Mathematics, Russia) *Structures of two-phase flow through double porosity media: numerical analysis* (p. 286)
16.15–16.30 MIYAZAKI, Teruo (Kokushikan University, Department of Mechanical Engineering, Japan) *Unsteady three-dimensional cascade flow solver using complex temperature gradients* (p. 289)
16.30–16.45 NOWAKOWSKI, Andrzej F (University of Manchester Institute of Science and Technology, UK) *A three dimensional simulation of fluid flow within a hydrocyclone* (p. 293)
16.45–17.00 ILIESCU, Traian (University of Pittsburgh, USA) *Numerical analysis for large eddy simulation* (p. 272)
17.00–17.15 ZHMAKIN, Alexander I (A.F.Ioffe Physical Technical Institute, St Petersburg, Russia) *Adaptive multi-grid methods for steady viscous flows on unstructured grids* (p. 332)
17.15–17.30 OHTSUKA, Kohji (Hiroshima-Denki Institute of Technology, Hiroshima, Japan) *Theoretical and numerical analysis of fracture in 2D case* (p. 294)
17.30–17.45 KERR, Gilbert (New Mexico Tech, USA) *An effective numerical algorithm for the annular crack problem* (p. 276)
17.45–18.00 NEDELKOVSKI, Igor (Faculty of Technical Sciences, St Kliment Ohridski University, Bitola, Macedonia) *Computational simulation of steam flow and heat transfer in power plant condensers using finite element method* (p. 292)

C-33 Appleton Tower, Room 2.A2
Numerical Linear Algebra and Discrete Mathematics
Chair(s): ARBENZ; DEBNATH

16.00–16.15 ALAM, Rafikul (Indian Institute of Technology Guwahati, India) *On the approximation of stable invariant subspaces* (p. 235)
16.15–16.30 HIRANO, Hiroyuki (Okayama University of Science, Japan) *The two-step preconditioned iterative method* (p. 270)
16.30–16.45 ARBENZ, Peter (ETH Zürich, Institut für Wissenschaftliches Rechnen, Switzerland) *A comparison of Eigenvalue solvers for electromagnetic fields in cavities* (p. 237)
16.45–17.00 LI, Lei (Faculty of Science, Yamaguchi University, Yamaguchi, Japan) *Fast parallel algorithms for Vandermonde determinants* (p. 283)
17.00–17.15 LU, Tzon-Tzer (Department of Applied Mathematics, National Sun Yat-sen University, Kaohsiung, Taiwan) *Inverses of 2×2 block matrices* (p. 285)
17.15–17.30 TAN, Roger C E (National University of Singapore, Singapore) *Computation of mixed partial derivatives of eigenvalues and eigenvectors by simultaneous iteration* (p. 316)
17.30–17.45 DEBNATH, Narayan C (Winona State University, USA) *SGPG: A graph for modelling concurrency* (p. 253)
17.45–18.00 SHIODE, Narushige (University College London, UK) *Application of graph theory for measuring the inter-connectivity of WWW sites* (p. 310)

C-36 Appleton Tower, Room 2D

Simulation, Neural Networks, Geometric Modelling, Linear and Nonlinear Programming

Chair(s): DORNINGER; GOFFIN

16.00–16.15 KIM, Hyeock-Jin (Chungwoon Univ, Korea) *Data exchange by the degree reduction of B-splines* (p. 278)

16.15–16.30 NAKAGAWA, Noritoshi (Hiroshima University, Faculty of Engineering, Japan) *Vibration characteristics of isolator using magneto-spring* (p. 292)

16.30–16.45 DORNINGER, Dietmar (Vienna University of Technology, Austria) *A cellular automaton model for chromosome pairing* (p. 255)

16.45–17.00 ZIMMERMANN, Wayne J (Texas Woman's University, Denton, USA) *A computational model to estimate the probability of impact with space debris* (p. 332)

17.00–17.15 HEITZER, Michael (Institute of Safety Research and Reactor Technology, Forschungszentrum Jülich GmbH, Germany) *Large scale nonlinear optimization for FEM-based limit and shakedown analysis* (p. 269)

17.15–17.30 POLLATSCHEK, Moshe A (Management, Technion, Haifa, Israel) *Graphic interface for model formulations* (p. 298)

17.30–17.45 GOFFIN, Jean-Louis (McGill University, Montreal, Canada) *Multiple cuts in the analytic center cutting plane method* (p. 263)

17.45–18.00 KREJIĆ, Nataša (Institute of Mathematics, University of Novi Sad, Yugoslavia) *A newton-like method with modification of right-hand side vector* (p. 280)

C-40 William Robertson Building, Seminar Room 3

Optimization II

Chair(s): RORRES; VARGA

16.00–16.15 TAN, Yongji (Institute of Mathematics, FuDan University, China) *Parameters optimization of continuous casting problem* (p. 316)

16.15–16.30 MOMBAUR, Katja D (IWR, University of Heidelberg, Germany) *Open-loop stable control of running and hopping robots* (p. 289)

16.30–16.45 RORRES, Chris (Drexel Unversity, USA) *The turn of the screw: the optimal design of an Archimedes screw* (p. 304)

16.45–17.00 LAZAREV, Alexander A (Kazan State University, Russia) *Analize of structure of optimal schedule the problem minimizing maximum lateness for single machine* (p. 283)

17.00–17.15 FRIEDLANDER, Ana (State University of Campinas, Brazil) *On the resolution of the generalized nonlinear complementarity problem* (p. 260)

17.15–17.30 STEFANOV, Stefan M (Neofit Rilski University, Blagoevgrad, Bulgaria) *Convex separable optimization problems - results, algorithms and some applications* (p. 313)

17.30–17.45 VARGA, Laszlo (Hungarian Power Companies Ltd., Hungary) *Approximation algorithms for maintenance scheduling in electric power systems* (p. 321)

17.45–18.00 DJURANOVIC-MILICIC, Nada (Faculty of Technology and Metallurgy, Yugoslavia) *A generalized curvilinear path step-size algorithm* (p. 254)

ICIAM 99
5-9 July 1999

Thursday, 8 July, Morning Session
Overview

	09.00 – 09.45 Plenary Lectures	
	Peter CONSTANTIN, *The Navier-Stokes Equations and Fluid Turbulence*	GS
	Margaret H WRIGHT, *What, if Anything, is New in Optimization?*	MH
	09.55 – 10.40 Plenary Lectures	
	Anthony D KENNEDY, *Do Large Computations Solve our Problems or Cause them?*	MH
	James A SETHIAN, *Fast Marching Methods and Level Set Methods: Evolving Interfaces in Fluid Mechanics, Computational Geometry and Materials Sciences*	GS
	11.00 – 13.00 Mini-Symposia	
MSP-027	The Motion of Systems Containing Rigid and Elastic Bodies in Resisting Continuum I	AFB-19
MSP-029	Several Faces of Forecasting	MS-4
MSP-053	Modulational Dynamics	WRB-10
MSP-061	Mathematical Methods in Solid Mechanics III	DHT-C
MSP-065	Mathematics Applied to Quantum Chemistry: Theoretical, Computational and Experimental Aspects III	DHT-4.01
MSP-074	Charge Transport, with Views From Science, Engineering, and Mathematics	DHT-N
MSP-083	Dynamical Systems in Manufacturing I	AT-8
MSP-098	Micromagnetics and Magnetic Materials	MS-5
MSP-128	Nonlinear Conservation Laws I	AT-6
MSP-133	Mathematical Modelling of Tumour Growth, Angiogenesis and Invasion I	WRB-1
MSP-137	The Wilkinson Prize for Numerical Software	MS-3
MSP-142	Mathematical and Computational Issues in Turbulence and Balanced Dynamics for Geophysical Flows	DHT-S
MSP-145	Computational Inverse Problems	AT-2B
MSP-146	New Challenges in Shape Optimization and Optimal Design I	AFB-10
MSP-149	Mathematics of Glass	MS-1
MSP-155	Typical Projects in a New Branch of Mathematical Research and Education I	AT-3
MSP-161	Analytical and Numerical Methods for Variational Image Processing I	DHT-3.01
MSP-165	Near-Singular Phenomena in Conservative Waves Equations and their Perturbations	WRB-2
MSP-166	Simulation and Models in Kinetic Theory I	WRB-9
MSP-172	Recents Developments of Mixed Finite Element Methods I	AT-5
MSP-176	Mixed Finite Element and Finite Volume Discretizations of Flows Through Porous Media	DHT-B
MSP-181	Mathematical Approaches to the Control of Fluid Flow I	AT-2
MSP-193	Numerical Methods for Singular Free Boundary Problems I	AT-4
MSP-250	Mathematical Modelling of Traffic Flow	DHT-4.18
MSP-258	Two-Phase Flows and Sedimentation I	AT-1
MSP-272	Industrial and Commercial Applications of Optimisation (EPCC Mini-Symposium)	WRB-11
MSP-273	Large Scale Applications of High Performance Computing (EPCC Mini-Symposium)	WRB-8
MSP-276	Tutorial: High Performance Computing Concepts (EPCC Mini-Symposium)	WRB-4
	11.00 – 13.00 Contributed Presentations: Lectures	

C-18	Electromagnetics and Semiconductors I	AFB-13
C-19	Mathematics In Industry I	AFB-14
C-20	Numerical Analysis II	AFB-17
C-26	Computational Mathematics	AFB-18
C-34	Partial Differential Equations II	AT-2.A2
C-43	Analysis, Asymptotics and Ordinary Differential Equations	AT-2D
C-48	Dynamical Systems, Analysis, Modelling and Systems Theory	WRB-3
C-49	Solid Mechanics and Material Science	DHT-3.18
	11.00 – 13.00 Contributed Presentations: Posters	
P-3	Posters III	DHT-LF

	Also today	
09.45	**1999 Wilkinson Prize presentation**, see p. 223	McEwan Hall
	Parallel Computing Special Interest day, see p. 222	

Thursday, 8 July, Morning Session
Details

09.00 – 09.45 Plenary Lectures

Plenary Lecture — George Square Lecture Theatre

Peter CONSTANTIN (University of Chicago, USA)

The Navier-Stokes Equations and Fluid Turbulence

Chair: J M BALL (Oxford University, UK)

We will discuss connections between rigorous mathematical constructs based on the Navier-Stokes equation on the one hand, and turbulence theory and experiment on the other. We will describe results concerning mixing, spectra and turbulent combustion.

Plenary Lecture — McEwan Hall

Margaret H WRIGHT (Bell Laboratories, New Jersey, USA)

What, if Anything, is New in Optimization?

Chair: I S DUFF (Rutherford Appleton Laboratory, UK)

Many ideas of recent interest in optimization have been around for a long time: Newton's method, barrier methods, and direct search methods, to name only a few. It has been argued that there is nothing new in the field, and that today's research is simply a rearrangement of old ideas. We shall analyze some of the major themes in optimization today in terms of novelty and other germane properties.

09.55 – 10.40 Plenary Lectures

Plenary Lecture McEwan Hall

Anthony D KENNEDY (University of Edinburgh, UK)

Do Large Computations Solve our Problems or Cause them?

Chair: I S DUFF (Rutherford Appleton Laboratory, UK)

Only the simplest mathematical models can be solved in closed form, and not only do such idealisations only approximate the details of the real solution, but sometimes they do not even get the solution qualitatively correct. Sometimes, in moments of enthusiasm, we believe that the numerical solution of more realistic models will tell us what is really going on; at other times we stare at the output from our computers and not only find them intuitively unenlightening, but also of highly questionable correctness.

I will argue for viewpoint that computational modelling is a tool which mathematicians will use more and more in the future, but that they need to understand how computational methods work and what they can and cannot tell us, just like any other mathematical technique.

I shall discuss the the rôle of high performance computing and simulation in the future of scientific research, stressing the importance of controlling errors in both mathematical models and their computational solution. In order to put this powerful tool in the hands of the working mathematician we need to learn how to find not only constructive methods of solving equations but also efficient ones, and furthermore methods which can be carried out by real parallel computers. Finally, I will argue that we also need to construct portable, efficient, reusable, and correct software and make use of the new methods and languages invented by computer scientists in order to lower the barriers to applying high performance computing to all the problems which can profit from it.

Plenary Lecture George Square Lecture Theatre

James A SETHIAN (University of California, USA)

Fast Marching Methods and Level Set Methods: Evolving Interfaces in Fluid Mechanics, Computational Geometry and Materials Sciences

Chair: J M BALL (Oxford University, UK)

Fast Marching Methods and Level Set Methods are numerical techniques for analyzing and computing interface motion in a host of settings. The Fast Marching Method is a boundary value formulation, while the Level Set Method method is an initial value formulation; both exploit numerical techniques borrowed from hyperbolic conservation laws to extract the correct viscosity solutions to these Eulerian partial differential equations. At their core, both rely on earlier work by the author on the theory and numerics of curve and surface evolution, and both are made efficient through adaptive versions, resulting in higher order schemes of optimal order.

We will review the underlying theory and algorithms behind these techniques, report on recent algorithmic advances, and discuss a large collection of applications, including optimal path planning in robotics, seismic analysis, aspects of computational geometry and computer-aided-design, shape recovery in computer vision and medical imaging, combustion and fluid mechanics, the formation of geometric singularities, and etching and deposition in semi-conductor manufacturing. An overview of the material may be found at http://math.berkeley.edu/~sethian/level_set.html

11.00 – 13.00 Mini-Symposia

MSP-027 Adam Ferguson Building, Room 19

The Motion of Systems Containing Rigid and Elastic Bodies in Resisting Continuum I

(see also Part II, MSP-038, p. 141; Part III, MSP-039, p. 155)

Organiser: ILJUKHIN, Alexander A (Pedagogical institute, Taganrog, Russia)

The set of reports includes researches in the field of dynamics of systems of rigid, elastic and liquid bodies in various force fields, including their interaction with an environment. These researches have arisen as theoretical integration of soluble applied problems in the fields of aerodynamics, rocket engineering and spacedynamics. Developed and used methods are connected with the nonlinear analysis of a motion of mechanical systems. This is their advantage over methods of the linear differential equations theory. The basic lack of these methods is their orientation to a certain class of problems. Such methods are: method of classification of configurations of flexible bodies, in case of finite displacements, nonlinear laws of interaction with continuum and force fields. Submitted reports will be interesting by virtue of novelty for a wide range of experts in the fields of motion stability of complex mechanical systems, creation of the theory of experiment for aerodynamic characteristics definition for continuum and bodies, and also for the experts in motion stability of the flexible space vehicles.

ILJUKHIN, Alexander A (Pedagogical institute, Taganrog, Russia) *Stability of the plain vibrations of two rigid bodies, connected with elastic rod* (p. 38)

IGNATYEV, Andrey A (Donetsk State University, Donetsk, Ukraine) *Research of the motions of the rigid body* (p. 38)

IGNATYEV, Alexander O (Institute for Applied Mathematics and Mechanics, Donetsk, Ukraine) *Stability of permanent rotations of rigid body containing liquid* (p. 38)

MSP-029 Management School, Lecture Theatre 4

Several Faces of Forecasting

Organiser: NASH, John C (Faculty of Administration, University of Ottawa, Canada)

Forecasting is an activity practiced in all areas of human activity. Forecasting is implicit in the enterprise of advancing science and technology through research and development, yet few workers directly address this issue, and few have training or experience in forecasting techniques. In the sense that modelling is forecasting, most applications of mathematics have a forecasting component. However, the methods used specifically to look forward in time by people who call themselves forecasters are rarely part of any mathematics or science syllabus. This mini-symposium aims to present several approaches to forecasting as it is taught and used. The purpose is to provide an introduction to the subject of forecasting and links to its mathematical underpinnings for practitioners in industrial and applied mathematics.

NASH, John C (Faculty of Administration, University of Ottawa, Canada) *Forecasting: A framework and graphical approaches* (p. 41)

BANASIK, John L (University of Edinburgh, UK) *Regression and Arima models* (p. 40)

DOUTRIAUX, Jerome A (Faculty of Administration, University of Ottawa, Ottawa, Canada) *Qualitative and long term forecasting* (p. 41)

MSP-053 William Robertson Building, Seminar Room 10

Modulational Dynamics

Organisers: KAPITULA, Todd (University of New Mexico, USA)
SCHNEIDER, Guido (Mathematisches Institut, Universität Bayreuth, Germany)

We consider bifurcation problems posed on unbounded cylindrical domains. Examples are hydrodynamical stability problems as the Taylor-Couette problem, Benard's problem, reaction-diffusion systems, equations in nonlinear optics, etc. So called amplitude or modulation equations as the Ginzburg-Landau equation, Fisher's equation, the Cahn-Hilliard equation, etc. can be derived to describe the bifurcating solutions. In the last years mathematical theories have been developed which show a deep connection between the original systems and the associated amplitude equations. Here new results for the amplitude equations are presented and methods in order to transfer these results to the original system are discussed.

SANDSTEDE, Björn (Ohio State University, USA) *Bifurcations from fronts and pulses caused by the essential spectrum* (p. 59)
VAN HECKE, Martin (CATS/ Niels Bohr Institute, Denmark) *Coherent structures and spatiotemporal chaos in the complex Ginzburg-Landau equation* (p. 59)
ROUGEMONT, Jacques (Theoretical physics, University of Geneva, Switzerland) *Dynamics of interfaces in the Ginzburg-Landau equation* (p. 58)
SCHNEIDER, Guido (Mathematisches Institut, Universität Bayreuth, Germany) *Stability of modulating fronts and pulses* (p. 59)
RUBIN, Jonathan (Ohio State University, USA) *Existence and stability of phase-slip solutions to the nearly real cubic Ginzburg-Landau equation* (p. 58)

MSP-061 David Hume Tower, Lecture Theatre C

Mathematical Methods in Solid Mechanics III

(see also Part I, MSP-059, p. 84; Part II, MSP-060, p. 103; Part IV, MSP-062, p. 141)

Organisers: KAPLUNOV, Julius D (Institute for Problems in Mechanics, Russia)
WAN, Frederic Y M (University of California, Irvine, USA)

HORGAN, Cornelius O (University of Virginia, USA) *Anisotropy induced singularities in linear elasticity* (p. 64)
MARKENSCOFF, Xanthippi (University of California, San Diego, USA) *The mechanics of thin ligaments* (p. 65)
ROGERSON, Graham A (Department of Computer and Mathematical Sciences, University of Salford, UK) *Some dynamic properites of idealised pre-stressed elastic plates* (p. 65)
ZAKHAROV, Dmitrii (Institute for Problems in Mechanics, Moscow, Russia) *Boundary value problems for composite laminates under bending-extension coupling* (p. 67)

MSP-065 David Hume Tower, Room 4.01

Mathematics Applied to Quantum Chemistry: Theoretical, Computational and Experimental Aspects III

(see also Part I, MSP-063, p. 84; Part II, MSP-064, p. 103; Part IV, MSP-066, p. 141)

Organiser: LE BRIS, Claude (Ecole Nationale des Ponts et Chaussées, France)

MADAY, Yvon (Laboratoire ASCI-CNRS, Orsay, France) *Error estimators for the approximation of the solution of Schrodinger's type equations* (p. 69)
CANCES, Eric (CERMICS, Ecole des Ponts, France) *On the convergence of SCF algorithms for the Hartree-Fock equations* (p. 68)
ESTEBAN, Maria J (CEREMADE, CNRS and Universite Paris IX-Dauphine, France) *Min-max characterization of energy levels in relativistic atoms* (p. 68)
SERE, Eric (CEREMADE, Universite Paris IX-Dauphine, France) *Solutions of the Dirac-Fock equations* (p. 70)
SAUE, Trond (IRSAMC, France) *Quaternion symmetry in relativistic molecular calculations* (p. 70)

MSP-074 David Hume Tower, Faculty Room North

Charge Transport, with Views From Science, Engineering, and Mathematics

Organiser: JEROME, Joseph W (Northwestern University, USA)

The scientific input will originate in biology, particularly ionic channels. The engineering input will come from the area of semiconductor devices, where a kinetic approach will be taken. The mathematical approach will involve numerical algorithms which are robust over significant changes in the physical parameters describing diffusion and friction. Since charge transport is involved, these systems must be self-consistent, i.e., must involve some form of electrostatic or electromagnetic consistency.

MSP-083 Appleton Tower, Seminar Room 8

Dynamical Systems in Manufacturing I

(see also Part II, MSP-084, p. 142; Part III, MSP-085, p. 155; Part IV, MSP-266, p. 171)

Organisers: BLACKMORE, Denis (New Jersey Institute of Technology, USA)
SAMOILENKO, Anatoliy M (Institute of Mathematics, National Academy of Sciences, Ukraine)
PRYKARPATSKY, Anatoliy K (AGH, Poland and Dept. of Nonlin. Mathem. Analysis, IAPMM of the NAS, Lviv, Ukraine)

We intend to explore a variety of applications of dynamical systems theory to modern manufacturing science and technology, including such areas as computer-aided design and manufacturing, and materials handling and processing. Our purpose is to demonstrate how such concepts as stability, bifurcation and chaos have numerous useful applications to problems arising in manufacturing industries. Thus we expect to attract an audience of both theoreticians and practitioners, and thereby improve communication between these groups.

MSP-098 Management School, Lecture Theatre 5

Micromagnetics and Magnetic Materials

Organisers: DESIMONE, Antonio (Max-Planck Institute for Mathematics in the Sciences, Germany)
MÜLLER, Stefan (Max-Planck Institute for Mathematics in the Sciences, Germany)

Magnetic materials exhibit complex microstructures on several interacting length scales (domains, walls, singular lines and points) which critically depend on material parameters and external fields. Understanding and controlling these structures is of large technological importance. At the same time magnetic materials provide an excellent model to study fundamental issues in multi-scale systems since there is a rich body of data from experiments and simulations. The goal of this symposium is to explore new analytical and computational approaches to magnetic microstructures in the light of recent advances in experimental techniques, theory and mathematical analysis. Topics to be covered will include: Domain patterns in thin and ultrathin films; Weak convergence and relaxation methods for the analysis of multiscale systems; Mathematical theory of 3d to 2d dimensional reduction; Computational advances, including adaptivity, relaxation techniques and fast evaluation of the demagnetizing energy; Applications (ferromagnetic shape memory, magnetorheological fluids).

SMYSHLYAEV, Valery (Department of Mathematical Sciences, University of Bath, UK) *Variational bounds for assemblages of fine ferromagnetic particles* (p. 100)
PROHL, Andreas (Christian-Albrechts-Universitaet Kiel) *Analysis of finite element approximation of microstructure in micromagnetics* (p. 99)
OTTO, Felix (University of California at Santa Barbara, USA) *Domain branching in type-I superconductors* (p. 99)
CHAPMAN, John N (Department of Physics and Astronomy, University of Glasgow, UK) *Experimental observations of domain structures in patterned magnetic thin films* (p. 99)
REITICH, Fernando (School of Mathematics, University of Minnesota, USA) *Calculation of the overall magnetic properties of magnetorheological fluids* (p. 99)

MSP-128 Appleton Tower, Seminar Room 6
Nonlinear Conservation Laws I
(see also Part II, MSP-129, p. 143)

Organisers: TRIVISA, Konstantina (Northwestern University, USA)
CHEN, Gui-Qiang (Northwestern University, USA)

Nonlinear Conservation Laws arise in continuum physics, fluid mechanics, particle physics and related applied areas. Most of the partial differential equations can be formulated in the nonlinear conservation law form. The Navier Stokes Equations and the Euler Equations are important examples of such systems having special features and rich applications. The aim of this minisymposium is to bring together experts with interests in the theoretical and applied aspects of Nonlinear Conservation Laws and to present the most recent research developments and significant contributions in this field. The minisymposium consists of two parts: I. Navier Stokes Equations and Related Topics. II. Hyperbolic Systems of Conservation Laws and Applications.

BALL, John M (University of Oxford, UK) *Global attractors for the 3D incompressible Navier-Stokes equations* (p. 123)
WANG, Dehua (University of California, Santa Barbara, USA) *Nonlinear magnetohydrodynamics* (p. 125)
SHELUKHIN, Vladimir (Lavrentyev Institute of Hydrodynamics, Russia) *Boundary layer for the compressible Navier-Stokes equations* (p. 124)
TZAVARAS, Athanasios E (University of Wisconsin-Madison, USA) *On various approximations of the nonlinear wave equation* (p. 125)
TRIVISA, Konstantina (Northwestern University, USA) *Global discontinuous solutions of the Navier-Stokes equations for compressible reacting flow* (p. 125)

MSP-133 William Robertson Building, Seminar Room 1
Mathematical Modelling of Tumour Growth, Angiogenesis and Invasion I
(see also Part II, MSP-134, p. 143)

Organiser: CHAPLAIN, Mark A J (University of Dundee, UK)

Mathematical models for the growth and development of solid tumours will be presented. A variety of modelling techniques, analytical and numerical methods will be used. Clinical implications will also be discussed.

BELLOMO, Nicola (Dip. Matematica, Politecnico di Torino, Italy) *Tumour-immune system competition: From cellular to continuum theories* (p. 127)
PETTET, Graeme J (Queensland University of Technology, Brisbane, Australia) *Cell migration in multicellular spheroids* (p. 128)
KING, John R (University of Nottingham, UK) *Mathematical modelling of avascular tumour growth* (p. 128)
BYRNE, Helen M (School of Mathematical Sciences, University of Nottingham, UK) *Modelling the effect of mutations in solid tumour growth* (p. 127)
SLEEMAN, Brian (Shool of Mathematics, University of Leeds, UK) *Mathematical models of tumour angiogenesis and the role of angiostatin* (p. 129)

MSP-137 Management School, Lecture Theatre 3

The Wilkinson Prize for Numerical Software

Organisers: HAMMARLING, Sven (NAG Ltd, Oxford, UK)
MORÉ, Jorge (Argonne National Laboratory, USA)

The Wilkinson Prize for Numerical Software was established in honour of the outstanding contributions to the field by James Hardy Wilkinson. The first two awards were presented at ICIAM91 and ICIAM95 and the third will be presented at ICIAM99. This minisymposium will feature presentations by the three prize winners, together with a review of Wilkinson's contribution and influence on the development of numerical software.

HAMMARLING, Sven (NAG Ltd, UK) *James Hardy Wilkinson and numerical software* (p. 130)
PETZOLD, Linda (University of California, Santa Barbara, USA) *Algorithms and software for sensitivity analysis and optimal control of differential-algebraic systems* (p. 130)
CARLE, Alan (Rice University, Houston, USA) *Not entirely automatic differentiation (Part II)* (p. 130)
WINNER OF WILKINSON PRIZE, To be announced (To be announced) *To be announced*

MSP-142 David Hume Tower, Faculty Room South

Mathematical and Computational Issues in Turbulence and Balanced Dynamics for Geophysical Flows

Organisers: MAHALOV, Alex M (Arizona State University, USA)
NICOLAENKO, Basil N (Arizona State University, USA)

The mathematics of rotating and stratified flows, particularly the reduced systems that emerge from asymptotic analyses, have played an important role in developing useful conceptual frameworks, especially in theoretical and numerical calculations. Much what is known about such flows has been gleaned from direct numerical simulation. The minisymposium will aim to establish what is actually rigorous in this subject, to focus attention on problems that require careful mathematical analysis and numerics. The role of the balanced and unbalanced dynamics in the numerical and theoretical modeling of geophysical turbulence and fronts will be considered. Rigorous results to be presented and benchmarked against numerical simulations include lagrangian dynamics, dynamics of ageostrophic fronts and energy and enstrophy spectra where three dimensional effects are important.

CONSTANTIN, Peter (The University of Chicago, USA) *The Littlewood-Paley spectrum in two-dimensional turbulence* (p. 135)
BRENIER, Yann (IUF and University Paris 6, France) *Homogeneous hydrostatic incompressible flows* (p. 135)
ROULSTONE, Ian (Meteorological Office, UK) *Monge-Amère equations in balanced models* (p. 136)
JONES, Christopher K R T (Brown University, USA) *Challenges in assessing Lagrangian transport in ocean flows* (p. 135)
NICOLAENKO, Basil N (Arizona State University, USA) *Predictable unbalanced dynamics and ageostrophic wave fronts for geophysical flows* (p. 135)

MSP-145 Appleton Tower, Room 2B

Computational Inverse Problems

Organisers: SOMERSALO, Erkki J (Institute of Mathematics, Helsinki University of Technology, Finland)
KAIPIO, Jari P (Department of Applied Physics, University of Kuopio, Finland)

Inverse problems constitute an important and rapidly increasing field of applied mathematics, physics and engineering sciences with numerous applications e.g. in medical imaging, non-destructive testing, geophysics, and optimal design. Typically, inverse problems are non-linear in nature which complicates considerably both the theoretical and the numerical treatment of the problem. What is more, the inverse problems are often ill-posed. Therefore, special computational techniques need to be developed to treat them properly. This minisymposium concentrates on the numerical and computational aspects of inverse problems and their applications.

LESSELIER, Dominique (Laboratoire des Signaux et Systèmes, CNRS-SUPELEC-UPS, France) *On some computational issues in nonlinearized wavefield inversion* (p. 137)
DOBSON, David C (Texas A&M University, USA) *Determining periodic structures with maximal band gaps* (p. 137)
SILTANEN, Samuli (Helsinki University of Technology, Finland) *Non-iterative impedance imaging: Applying Nachman's method* (p. 137)
ARRIDGE, Simon R (Dept. Computer Science, University College London, UK) *Topics in optical tomography* (p. 137)
WÜBBELING, Frank (Institut für Numerische und Instrumentelle Mathematik, University of Münster, Germany) *title tbc*

MSP-146 Adam Ferguson Building, Room 10
New Challenges in Shape Optimization and Optimal Design I
(see also Part II, MSP-147, p. 144)

Organisers: CAGNOL, John (Ecole des Mines de Paris, France)
ZOLÉSIO, Jean-Paul (Ecole des Mines de Paris et CNRS, France)

Shape Optimization, Optimal Design, Geometric Optimization have expanded and merged into a very broad field of activity where the optimization or control variable is a generalized geometry: a shape, a structure, a micro-structure. In so doing it borrows tools and ideas from a broad spectrum of mathematical areas and raises deep questions and issues about general and efficient numerical approaches to their solutions. Applications to design of dams, heat convection, Navier-Stokes, flow control, inductor coils, etc., are presented along with theoretical, optimization and sensitivity results.

BOISGÉRAULT, Sébastien (Ecole des Mines de Paris, France) *Shape sensitivity analysis for the Navier-Stokes equations* (p. 138)
CAGNOL, John (Ecole des Mines de Paris, France) *Shape optimization for the Maxwell equation* (p. 138)
DÉTEIX, Jean (Université de Montréal, Canada) *Maximal slope stability of soils by use of reinforcing material: A shape optimization formulation* (p. 138)
DZIRI, Raja (Université de Tunis, France) *Shape-sensitivity analysis for nonlinear heat convection* (p. 138)

MSP-149 Management School, Lecture Theatre 1
Mathematics of Glass

Organiser: MATTHEIJ, Robert M (Department of Mathematics, Technische Universiteit Eindhoven, Netherlands)

Glass is an interesting material, which, despite its use in often non-high-tech applications is a nice subject for mathematical modelling. When glass is heated is behaves like a highly viscous Newtonian flow. The problems deal with the flow equations which should sometimes be coupled with the energy equation, when the flow is non-isothermal. This minisymposium will address a variety of problems dealing with such questions. One is the production of molten glass itself in an oven. The so called GTM (glass tank model) is a way to describe a number of phenomena (from combustion to heat up the batch material to the final homogeneous glass flow coming out of the oven). Since heat transfer is mainly due to radiation another talk will address radiative heat transfer. For actual glass products one is of course intereested in the morphology aspects. There will be two examples of this. One is the saging of glass (like in making car screens) and the other in producing glass fibres.

TUCK, Ernest O (University of Adelaide, Australia) *Slumping of molten glass* (p. 140)
GELDER, David (Pilkington, UK) *The high temperature limit on glass fibre drawing* (p. 140)
SIEDOW, Norbert (Institute for Industrial Mathematics (ITWM), Kaiserslautern, Germany) *Applications of radiative transfer in glass industry* (p. 140)
NEFEDOV, Seva (Department of Mathematics, Eindhoven University of Technology, Netherlands) *The glass tank model* (p. 140)

MSP-155 Appleton Tower, Lecture Theatre 3

Typical Projects in a New Branch of Mathematical Research and Education I

(see also Part II, MSP-156, p. 144)

Organiser: BUNSE-GERSTNER, Angelika (Zentrum fuer Technomathematik, Fachbereich 3/ Mathematik und Informatik, Universität Bremen, Germany)

During the last two decades a new branch of mathematical research and education has been established as "Industrial Mathematics" or - in German speaking countries also - as "Technomathematics" at many universities. It is focussed on developing and evaluating mathematical models for technical systems and providing analytical and numerical methods to simulate and optimize them. Interdisciplinary research projects and cooperations with industry are essential for research and education in this field. This minisymposium presents typical examples from German and Austrian universities for research projects in this field employing various analytical and numerical methods. The speakers will discuss the mathematical approach and also comment on the problems that can arise in this mathematical academic-industrial cooperation.

BINDER, Andreas (MathConsult GmbH, Austria) *Technomathematics for small and medium-sized enterprises* (p. 145)

LINDNER, Ewald H (Institute of Analysis and Computational Mathematics, University Linz, Austria) *Mass saving on an injection moulding machine and following projects* (p. 146)

BÄNSCH, Eberhard (Zentrum für Technomathematik, University of Bremen, Germany) *Crystal growth - a demanding application for flow simulation and free boundary problems* (p. 145)

EGELJA, Aleksandra (Institute for Applied Mathematics, Freiburg, Germany) *Design tools for compressible viscous flow through two stroke engines* (p. 146)

BÖHM, Michael (Universität Bremen, Zentrum für Technomathematik, Germany) *Chemically driven corrosion in concrete* (p. 146)

MSP-161 David Hume Tower, Room 3.01

Analytical and Numerical Methods for Variational Image Processing I

(see also Part II, MSP-162, p. 144)

Organisers: SPITALERI, Rosa Maria (Istituto per le Applicazioni del Calcolo-CNR, Roma, Italy)
MARCH, Riccardo (Istituto per le Applicazioni del Calcolo-CNR, Roma, Italy)

Variational methods with free discontinuities have been proposed for various image processing problems, such as the Mumford and Shah (MS) significant variational model for image segmentation. The main computational difficulty is determined by the presence of unknown discontinuity curves in the solution. The minisymposium deals with analytical methods for the approximation of functionals depending on free discontinuities by means of Γ-convergence, and numerical methods for the solution of the associated minimization problems. Specific subjects are second order variational problems for surface reconstruction, variational convergence for discrete optimization methods, multigrid finite difference approximation of the Euler equations for the MS functional.

MARCH, Riccardo (Istituto per le Applicazioni del Calcolo-CNR, Roma, Italy) *Visible surface reconstruction by using a second order variational method with free discontinuities* (p. 150)

ROSATI, Mario (Istituto per le Applicazioni del Calcolo-CNR, Roma, Italy) *Convex-concave functionals in computer vision* (p. 150)

VITULANO, Domenico (Istituto per le Applicazioni del Calcolo-CNR, Roma, Italy) *Numerical analysis of a nonconvex variational problem in image selective smoothing* (p. 151)

MSP-165 William Robertson Building, Seminar Room 2

Near-Singular Phenomena in Conservative Waves Equations and their Perturbations

Organisers: SCHOBER, Constance M (Dept of Mathematics and Statistics, Old Dominion University, Norfolk VA, USA)
CALINI, Annalisa (Dept of Mathematics, College of Charleston, Charleston, USA)

This minisymposium discusses several related equations in which the presence of low-dimensional structures such as homoclinic orbits and blow-up solutions explain the occurrence of chaotic dynamics, focusing events, topological changes and long-term behaviour observed in physical experiments in the fields of oceanography, vortex filament dynamics, and plasma physics. The focusing nonlinear Schroedinger equation and its perturbations, and the Benjamin-Ono equation will be discussed using techniques which include Theta function theory, perturbation methods and inverse spectral theory for soliton equations, numerical nonlinear spectral analysis, adaptive-grid computational methods, and regularization techniques for solutions in the proximity of blow-up.

MSP-166 William Robertson Building, Seminar Room 9

Simulation and Models in Kinetic Theory I

(see also Part II, MSP-167, p. 144)

Organisers: LAMPIS, Maria (Dipartimento di Matematica del Politecnico di Milano, Italy)
CERCIGNANI, Carlo (Dipartimento di Matematica del Politecnico di Milano, Italy)

Recent results in the modelling and numerical analysis in kinetic theory are presented, that are important in astronautics and in high altitude aerodynamics. Models of interactions between molecules, dissociation phenomena of diatomic molecules and models of the corresponding scattering operators are proposed and discussed. Scattering operators of the extended kinetic theory and their hydrodynamic limits are also investigated. Rarefied plane or axisymmetric gas flows are analyzed numerically by Direct Simulation Monte Carlo Method (DSMC), and by accurate finite-difference analysis of the Boltzmann-Krook-Welander equation.

MSP-172 Appleton Tower, Lecture Theatre 5

Recents Developments of Mixed Finite Element Methods I

(see also Part II, MSP-173, p. 145)

Organiser: THOMAS, Jean-Marie (University of Pau, France)

Mixed finite element methods for second order elliptic problems are now a classical alternative to conforming finite element methods. Versus conforming and least squares methods, the fundamental advantage of mixed methods is that they are conservative. In the first session of this minisymposium, some links between mixed and nonconforming methods as well as finite volume methods will be shown. There will also be given some examples of the application to mixed methods of tools recently developed on conforming methods, such as adaptive meshes and robustness analysis. The second session will be dedicated to extensions of these mixed methods to the exterior problem, the elasticity system and the Maxwell system. The intended audience is the community of applied mathematicians and engineers who work on numerical simulation of PDE.

MARINI, Donatella (Universita' di Pavia and IAN-CNR, Pavia, Italy) *An analysis of discontinuous Galerkin methods for diffusion problems* (p. 161)

CAPATINA-PAPAGHIUC, Daniela (University of Pau, France) *Coupling of primal and mixed finite elements for a parameter-dependent problem* (p. 160)

WOHLMUTH, Barbara (University Augsburg, Germany) *An iterative substructuring method for Raviart-Thomas vector fields in three dimensions* (p. 161)

MAITRE, Jean-Francois (Equipe d'Analyse Numerique Lyon-St Etienne, CNRS UMR, France) *Relations between mixed, nonconforming finite elements, and finite volumes: Application to a posteriori error estimation for finite volume schemes* (p. 160)

MSP-176 David Hume Tower, Lecture Theatre B

Mixed Finite Element and Finite Volume Discretizations of Flows Through Porous Media

Organiser: KNABNER, Peter (University of Erlangen-Nuremberg, Germany)

Flow and transport problems in porous media require - as many other fields of science and engineering - an accurate computation of the fluid velocity combined with correct qualitative properties, e.g. local mass conservation. Contrary to conformal finite element methods, mixed finite element or cell-centered finite volume methods provide these properties. The methods are developed, however, mostly for scalar linear elliptic problems, whereas flow and transport problems in porous media are usually described by nonlinear parabolic systems, which may be even convection-dominated or type-changing. The lectures address these difficulties for various models including the question of adaptivity.

DAWSON, Clint (University of Texas at Austin, USA) *Upwind-mixed and local discontinuous Galerkin finite element methods for groundwater transport problems* (p. 163)

SCHNEID, Eckhard (University of Erlangen-Nuremberg, Germany) *Stability of an adaptive mixed finite element discretization of saturated-unsaturated flows in porous media* (p. 164)

JAFFRÉ, Jérôme (INRIA-Rocquencourt, France) *Mixed-hybrid finite elements for two-phase flow in porous media with two rock types* (p. 164)

ESPEDAL, Magne (Department of Mathematics, University of Bergen, Bergen, Norway) *Finite volume based local grid refinements for simulation of multiphase flow in fractured reservoirs* (p. 164)

MSP-181 Appleton Tower, Lecture Theatre 2

Mathematical Approaches to the Control of Fluid Flow I

(see also Part II, MSP-182, p. 145)

Organiser: HINZE, Michael (Fachbereich Mathematik, Technische Universität Berlin, Germany)

The control of fluid flow and the optimization of its characteristics have become a challenging area of mathematical and engineering research in the last decade. Typical applications include the reduction of drag and the elimination of the transition from laminar to turbulent flow regime. The set of control concepts to be discussed contains robust control, optimal control, instantaneous control as well as concepts based on system reduction. A variety of mathematical problems closely connected to these control concepts are at issue: concise mathematical and physical modelling, existence, uniqueness and regularity of solutions to the corresponding nonlinear optimization problems, asymptotic behaviour of controllers as well as numerical analysis and numerical simulation. The speakers cover the wide range from mathematical analysis to mechanical engineering and, thereby, focus on the main issues mentioned above. Moreover, they will address the future trends of research in the field.

TEMAM, Roger (Indiana University, Department of Mathematics, USA) *Robust control of Navier Stokes equations* (p. 168)

MARDUEL, Xavier (SFB Optimierung und Kontrolle, Karl Franzens Universitat, Graz, Austria) *Sub-optimal control of transient non-isothermal viscoelastic fluid flows* (p. 168)

KAUFFMANN, Andreas (Technische Universität Berlin, Germany) *Control of fluid flow using reduced order models* (p. 167)

BEWLEY, Thomas R (Department of MAE, UC San Diego, USA) *Application of linear feedback to nonlinear problems in fluid mechanics* (p. 167)

MSP-193 Appleton Tower, Lecture Theatre 4

Numerical Methods for Singular Free Boundary Problems I

(see also Part II, MSP-194, p. 146)

Organiser: FALCONE, Maurizio (Dipartimento di Matematica, Universita' di Roma "La Sapienza", Roma, Italy)

Many applications require an accurate computation of moving interfaces, e.g. hardening processes in steel industry, crystal growth and other deposition problems, the non linear filtering in image processing. All the above problems correspond to nonlinear evolutive partial differential equations which can be degenerate. Since the solution can develop singularities and the topology of the interface can change in finite time there is a need for highly accurate numerical methods which are stable with respect to those degeneracies. From the mathematical point of view, the notion of "viscosity solution" plays a crucial role to define the interface after the onset of singularities. In order to compute sharp interfaces, several techniques have been developed: adaptive finite elements, high order finite differences and semi-lagrangian methods. The Minisymposium will present some examples of those techniques and applications to significant industrial problems.

ENGQUIST, Bjorn (NADA -KTH, Stockholm, Sweden) *A new interface propagation method in multi-phase flows*

RUUTH, Steven (UCLA, Department of Mathematics, USA) *A simple scheme for geometrical optics and related PDEs* (p. 178)

MAKRAKIS, George N (Institute of Applied and Computational Mathematics, FORTH-Hellas, Heraklion, Crete, Greece) *High-frequency computations near caustics and applications in underwater acoustics* (p. 177)

FALCONE, Maurizio (Dipartimento di Matematica, Universita' di Roma "La Sapienza", Italy) *Semi-Lagrangian schemes for front propagation problems and applications* (p. 177)

DZIUK, Gerhard (Institut für Angewandte Mathematik, Universität Freiburg, Germany) *Computation of curvature dependent free surface flows and phase transitions* (p. 176)

MSP-250
David Hume Tower, Room 4.18

Mathematical Modelling of Traffic Flow

Organisers: SMIRNOV, Nickolay N (Mech. & Math. Faculty of Moscow MV Lomonosov State Univ., Russia)
KISELEV, Alexey B (Mech. & Math. Faculty of Moscow MV Lomonosov State Univ., Russia)

The problem of modelling traffic flows is very acute for long-term forecasts of transport networks development in the cities and regions. Adequate models for transport flows enable to develop optimal traffic regulation. The papers presented at the section address the key issues of the problem: the theory of traffic flows, based on continuum mechanics models, modelling traffic "humps" migration on the roads, practical measures in traffic regulation in the cities. The problems could be interesting for both specializing in nonlinear partial differential equations and engineers involved in roads construction or traffic regulation.

SMIRNOV, Nickolay N (Mech.&Math. Faculty of Moscow MV Lomonosov State Univ., Russia) *Mathematical theory of traffic flows* (p. 215)
KISELEV, Alexey B (Mech.&Math. Faculty of Moscow MV Lomonosov State Univ., Russia) *Computer simulation of density waves on the roadsand computer simulation of density waves on the roads* (p. 214)
YUMASHEV, Michael V (Institute of Mechanics of Moscow MV Lomonosov State Univ., Russia) *Analitical method for transport flows characteristics development* (p. 215)
KOGAN, Robert A ("Souzdornii" of the Ministry of Transport, Russia) *Traffic regulations on the ring roads of Moscow and St Petersburg*

MSP-258
Appleton Tower, Lecture Theatre 1

Two-Phase Flows and Sedimentation I
(see also Part II, MSP-259, p. 147)

Organiser: WENDLAND, Wolfgang L (University of Stuttgart, Germany)

Deterministic and stochastic models of transport of contaminants and sedimentation-consolidation problems are decisive in industrial applications as oil exploration, environmental contamination, copper mining, sewage processing and evolution of rivers. Conservation laws and constitutive relations lead to mathematical models involving systems of nonlinear partial differential equations, e.g. Navier-Stokes-type coupled with degenerating parabolic-hyperbolic equations. The stochastic models yield stochastic differential equations whose simulations allow the justification of some of the empirical laws used in deterministic models. The Minisymposium will present state of the art numerical methods as well as mathematical modelling and corresponding mathematical and numerical analyses.

EWING, Richard E (Institute for Scientific Computation, Texas A&M University, USA) *Simulation of contaminant transport involving two-phase flows* (p. 220)
BÜRGER, Raimund (University of Stuttgart, Germany) *Model equations for sedimentation-consolidation processes* (p. 219)
SCHAFLINGER, Uwe H (University of Technology, Graz, Austria) *Resuspension phenomena in laminar flows* (p. 221)
DIEHL, Stefan (Centre for Mathematical Sciences, Lund University, Sweden) *Uniqueness problems in the one-dimensional modelling of continuous sedimentation* (p. 220)

MSP-272
William Robertson Building, Seminar Room 11

Industrial and Commercial Applications of Optimisation (EPCC Mini-Symposium)

Organisers: SIMPSON, Alan D (EPCC, The University of Edinburgh, UK)
DARLING, Gordon (EPCC, The University of Edinburgh, UK)

The development and availability of High Performance Computers with associated software and tools has made feasible the modelling of a number of Operational Research, Control Theory and Process Control problems that were previously impossible or too difficult to tackle owing to their complexity, data intensiveness and computational demands. Within this session, examples are given of the application of various techniques to optimally solve Industrial and Commercial problems. These range from Large Scale Linear Programming to data mining and knowledge based systems with applications in areas as diverse as the Pensions Industry, Manufacturing and Reservoir control.

KALLIO, Markku (Helsinki School of Economics, Finland) *Parallel computing for large-scale convex optimization* (p. 228)
SLOAN, Terry M (EPCC, The University of Edinburgh, UK) *Experiences in extracting useful information from data* (p. 228)
BAXTER, Rob M (EPCC, The University of Edinburgh, UK) *Well, what can you deliver?* (p. 228)
ARCHIBALD, Tom (Business Studies, The University of Edinburgh, UK) *Comparison of linear programming and dynamic programming on large scale reservoir optimization problems* (p. 227)

MSP-273 William Robertson Building, Lecture Theatre 8
Large Scale Applications of High Performance Computing (EPCC Mini-Symposium)

Organisers: SIMPSON, Alan D (EPCC, The University of Edinburgh, UK)
HENTY, David S (EPCC, The University of Edinburgh, UK)

The scale and complexity of a great many problems within traditional mathematical modelling areas — Astrophysics, Aerodynamics, QCD etc — led to great strides being made in the field of Large Scale Simulation as suitable hardware and software was developed. Previously intractable problems could be examined as computing power permitted more computationally demanding approaches to be adopted. An increased awareness of the High Performance Computing methods and greater access to HPC facilities has led, however, to the adoption of Large Scale Simulation approaches within a number of non-traditional fields, including Geographical modelling and Internet Protocol verification. This session discusses the uses and developments — in both traditional and novel fields — of Large Scale Simulations to predict, verify and assess model and tool behaviour.

BOOTH, Stephen P (EPCC, The University of Edinburgh, UK) *Zero to infinity* (p. 228)
LAVANTE, Ernst von (University of Essen, Germany) *Numerical simulations of vortical flows using parallel computers* (p. 229)
WESTHEAD, Martin (EPCC, The University of Edinburgh, UK) *Intersim: Large scale simulation of internet traffic* (p. 229)
OPENSHAW, Stan (University of Leeds, UK) *Developing and applying smart geographical data mining tools to GIS databases* (p. 229)

MSP-276 William Robertson Building, Seminar Room 4
Tutorial: High Performance Computing Concepts (EPCC Mini-Symposium)

Organisers: SIMPSON, Alan D (EPCC, The University of Edinburgh, UK)
HENTY, David S (EPCC, The University of Edinburgh, UK)

High Performance Computing is assuming an increasingly important role in many areas of science, where computer simulation can offer an attractive alternative to experimental investigation. This tutorial provides an introduction to the fundamental concepts of HPC. Topics covered will include parallel computer architectures, programming paradigms for HPC, an introduction to parallel algorithms and problem decomposition techniques. Key examples of applications of high performance computing in the scientific domain will be discussed.

MINTY, Elspeth (EPCC, The University of Edinburgh, UK) *Introduction to High Performance Computing* (p. 231)
SIMPSON, Alan D (EPCC, The University of Edinburgh, UK) *HPC architectures* (p. 231)
BULL, Mark (EPCC, The University of Edinburgh, UK) *HPC programming models and languages* (p. 231)
HENTY, David S (EPCC, The University of Edinburgh, UK) *Case studies in HPC* (p. 231)

11.00 – 13.00 Contributed Presentations: Lectures

C-18 Adam Ferguson Building, Room 13

Electromagnetics and Semiconductors I

Chair(s): SMITH; AUCHMUTY

11.00–11.15 VINOGRADOV, Sergey S (Department of Mathematics, University of Dundee, UK) *Wave scattering from elliptic plates* (p. 323)
11.15–11.30 VINOGRADOVA, Elena D (Department of Mathematics, University of Dundee, UK) *Electromagnetic diffraction from spheroidal cavities* (p. 323)
11.30–11.45 SMITH, Paul D (Department of Mathematics, University of Dundee, UK) *Electrostatic potential of electrified polygonal plates* (p. 312)
11.45–12.00 HEBERMEHL, Georg (Weierstrass Institute for Applied Analysis and Stochastics, Germany) *Simulation of microwave integrated circuits and multi-chip modules* (p. 268)
12.00–12.15 STROM, Staffan E G (Department of Electromagnetic Theory, Royal Institute of Technology, Sweden) *Spectrum of open periodic and waveguide resonators: their significance for the response to external excitations* (p. 314)
12.15–12.30 No talk
12.30–12.45 AUCHMUTY, Giles (Department of Mathematics, University of Houston, USA) *The 3D magnetostatic boundary value problem* (p. 238)
12.45–13.00 SEO, Jin Keun (Yonsei University, Seoul, Korea) *Inverse conductivity problems: Error estimates and approximate identification* (p. 308)

C-19 Adam Ferguson Building, Room 14

Mathematics In Industry I

Chair(s): OLIVAR; BAUMGART

11.00–11.15 CROMME, Ludwig J (BTU Cottbus, Germany) *Process optimization in the packaging industry/energy industry* (p. 251)
11.15–11.30 QUINTELA, Peregrina (Departamento de Matemtica Aplicada, Universidade de Santiago de Compostela, Spain) *Mathematical analysis and numerical simulation of a nonlinear thermo-viscoelastic problem arising in aluminium casting* (p. 301)
11.30–11.45 OLIVAR, Gerard (Universitat Politecnica de Catalunya, Spain) *Modelling switching networks by a one dimensional complex map* (p. 294)
11.45–12.00 ZHENG, Qinghua (Siemens AG Munich, Germany) *Multiframe technique for flow problems with time varying geometries* (p. 331)
12.00–12.15 TARNOPOLSKAYA, Tanya (CSIRO, Canberra, Australia) *An efficient method for strip flatness analysis in cold rolling* (p. 317)
12.15–12.30 ANDERSON, Harry C W (AMAC, Cranfield University, UK) *Quasi-steady state model of a gravity driven fluid sheet* (p. 235)
12.30–12.45 BAUMGART, Andreas (Forskningscenter Risø, Prøvestationen for vindmøller, Denmark) *Aerodynamic stability of wind turbine blades* (p. 241)
12.45–13.00 POSTAN, Mikhail Ya (Odessa State Varitime University, Ukraine) *Optimal control of multi-nomenclature inventory in continuous production under uncertainty* (p. 299)

C-20 Adam Ferguson Building, Room 17
Numerical Analysis II
Chair(s): ATKINSON; ROCHE

11.00–11.15 AOYAMA, Yuji (Toyo Communication Equipment Co Ltd, Japan) *Component mode synthesis for large scale structural vibration analysis* (p. 236)
11.15–11.30 KWAK, Do Y (Korea Advanced Inst. Sci. Tech(KAIST), Korea) *Extraordinary convergence of multigrid method for triangular grid* (p. 282)
11.30–11.45 ATKINSON, Kendall E (University of Iowa, Iowa City, Iowa, USA) *The planar radiosity equation and its numerical solution* (p. 238)
11.45–12.00 COOPER, Amanda (University of Ulster at Coleraine, Northern Ireland, UK) *Efficient schemes for external orthogonalization in the Lanczos algorithm* (p. 249)
12.00–12.15 FABIJONAS, Bruce (National Institute of Standards and Technology, USA) *The computation of special functions in parallel* (p. 258)
12.15–12.30 SHOJI, Mayumi (Nihon University, Japan) *Calculation of new types of progressive water wave* (p. 310)
12.30–12.45 ROCHE, Jean R (Université Henri Poincaré Nancy I, France) *Adaptive technique in Newton-like shape optimization methods* (p. 303)
12.45–13.00 MIYAKODA, Tsuyako (Osaka University, Japan) *On the computation of the characteristic values of the Mathieu function* (p. 288)

C-26 Adam Ferguson Building, Room 18
Computational Mathematics
Chair(s): BELEN; HIRAYAMA

11.00–11.15 ALDUNCIN, Gonzalo (Institute of Geophysics, UNAM, Mexico) *Macro-hybrid mixed finite element schemes for control advection-diffusion problems* (p. 235)
11.15–11.30 DE SIMONE, Valentina (University of Naples & CPS-CNR, Italy) *Parallel computational issues for image processing* (p. 253)
11.30–11.45 BELEN, Selma (University of Adelaide, Adelaide, Australia) *Stochastic rumours with general initial conditions* (p. 241)
11.45–12.00 PEREIRA, Maria G (GEIASC, Brazil) *Project programming system with multiple resource restrictions* (p. 297)
12.00–12.15 MACKENS, Wolfgang (Technical University Hamburg-Harburg: Section of Mathematics, Germany) *Convergence analysis of Newton type couplings of subsystem solvers* (p. 286)
12.15–12.30 PARK, Eun-Jae (Dept of Math, Yonsei University, Seoul, Korea) *Mixed finite element domain decomposition methods for parabolic problems* (p. 297)
12.30–12.45 HIRAYAMA, Hiroshi (Kanagawa Intitute of Technology, Japan) *A variable and multiple-precision arithmetic package for C++ language* (p. 270)
12.45–13.00 BARTON, Stanislav (Dept. of Physics, Mendel University in Brno) *LSQ method for nonlinear piecewise defined functions - Maple solution* (p. 240)

C-34 Appleton Tower, Room 2.A2
Partial Differential Equations II
Chair(s): HAMEL; KEYFITZ

11.00–11.15 LI, Tong (Department of Mathematics, University of Iowa, Iowa City, USA) *Global bv solutions and relaxation limit for a traffic flow model* (p. 284)
11.15–11.30 GAWINECKI, Jerzy August (Institute of Mathematics, Military University of Technology, Warsaw, Poland) *Local existence of the solution to the initial-boundary value problem in nonlinear thermodiffusion in micropolar medium* (p. 262)
11.30–11.45 HAMEL, François (CNRS, University of Paris VI, France) *Conical-shaped solutions of semilinear elliptic equations in* $\mathbb{R}^N$ (p. 267)
11.45–12.00 ACHE, Gerardo A (Facultad de Ciencias-Universidad Central de Venezuela, Caracas, Venezuela) *Numerical solution of a second-order quasilinear elliptic partial differential equation in certain unbounded cylindrical domains* (p. 234)
12.00–12.15 DEMEIO, Lucio (Dip. di Matematica "V.Volterra", Universita' di Ancona, Italy) *Collisional relaxation of undamped plasma waves* (p. 253)
12.15–12.30 WATSON, Stephen J (Louisiana State University, USA) *On temporal asymptotics in one-dimensional nonlinear thermoviscoelasticity with phase transitions* (p. 326)
12.30–12.45 KEYFITZ, Barbara L (University of Houston, USA) *Transonic shocks in steady and quasisteady flows* (p. 277)
12.45–13.00 PASCA, Daniel (University of Oradea, Romania) *Periodic solutions of second order systems in infinite dimensional Hilbert spaces* (p. 297)

C-43 Appleton Tower, Room 2D
Analysis, Asymptotics and Ordinary Differential Equations
Chair(s): BISCAIA; SUCIU

11.00–11.15 BRYKALOV, Sergei A (Institute of Mathematics & Mechanics, Ekaterinburg, Russia) *Systems with nonlinear nonlocal boundary conditions* (p. 244)
11.15–11.30 MAILYBAEV, Alexei A (Moscow State Lomonosov University, Russia) *On application of miniversal deformations to the stability theory* (p. 286)
11.30–11.45 BISCAIA, Evaristo C, Jr (COPPE/UFRJ, Rio de Janeiro, Brazil) *Solving large scale DAE models in PVP platforms* (p. 242)
11.45–12.00 SEYRANIAN, Alexander P (Moscow State Lomonosov University, Russia) *On singularities of stability boundaries of linear Hamiltonian systems* (p. 308)
12.00–12.15 GAVRILOV, Serge (Institute for Problems in Mechanical Engineering RAS, Russia) *Passage through the critical velocity by a moving load in elastic waveguide: asymptotical solution* (p. 262)
12.15–12.30 GAIKO, Valery A (Belarussian State University of Informatics and Radioelectronics, Belarus) *Termination principle and its application to Hilbert's 16th problem* (p. 261)
12.30–12.45 SUCIU, Elena Alina (Polytechnic University of Bucharest, Romania) *Modeling morphisms for Nagy-Foias diagrams* (p. 314)
12.45–13.00 No talk

C-48 William Robertson Building, Seminar Room 3
Dynamical Systems, Analysis, Modelling and Systems Theory
Chair(s): GEDDES; GAVRILOVA

11.00–11.15 SHABOZOV, Mirgand (Tajik National State University, Tajikistan) *N-widths of the some classes of functions analytic in the unit circle* (p. 308)
11.15–11.30 SHARMA, B K (Pt Ravishankar Shukla University,Raipur, India) *Existence results for a class of non-linear operators* (p. 309)
11.30–11.45 GEDDES, John B (University of New Hampshire, USA) *Extracting signals from chaotic laser data* (p. 262)
11.45–12.00 LU, Kai-Sheng (Wuhan Transportation University, China) *Structural conditions of controllability & observability over F(Z) for RLC networks* (p. 285)
12.00–12.15 CEPITIS, Janis (Institute of Mathematics of Latvian Academy of Sciences and University of Latvia, Latvia) *Moisture diffusion and attachment in wood* (p. 246)
12.15–12.30 PREVOST, Xavier (Cranfield University, UK) *3D quasi-steady water flows* (p. 299)
12.30–12.45 GAVRILOVA, Elena G (University of Mining & Geology "St. Ivan Rilski", Bulgaria) *Hydroelasticity of thin cylindrical shells with elastic inclusions* (p. 262)
12.45–13.00 GRIKUROV, Valery (St Petersburg University, Russia) *High-frequency asymptotics in the direction of total-reflection angle over convex interface* (p. 264)

C-49 David Hume Tower, Room 3.18
Solid Mechanics and Material Science
Chair(s): ORLOV; OINAM

11.00–11.15 SHEVCHUK, Victor (Pidstryhach Institute for Applied Problems of Mechanics and Mathematics, National Academy of Sciences of Ukraine, Lviv, Ukraine) *Approximate calculation of stresses in solids with thin multilayer coatings* (p. 309)
11.15–11.30 SHURYGIN, A M (Dept of Mech and Math, Moscow State University, Russia) *Statistical analysis and long-term prediction of seismicity for linear zones* (p. 310)
11.30–11.45 ORLOV, Stepan Gennadevich (St Petersburg State Technical University, Russia) *Mechanics of rods as a result of asymptotic analysis of three-dimensional elasticity problem* (p. 295)
11.45–12.00 YAKOUBENKO, Tatiana A (Moscow State University, Moscow, Russia) *Averaging of processes in periodic media with periods of different orders in the different directions* (p. 329)
12.00–12.15 CRACIUN, Eduard M (Ovidius University, Romania) *Fracture of a prestressed isotropic material containing a crack acted by incremental shear stresses* (p. 250)
12.15–12.30 ELISEEV, Kirill Valentinovich (St Petersburg State Technical University, Russia) *Creep analysis at the local nonuniformity of reological properties* (p. 257)
12.30–12.45 OINAM, Gourakishwar Singh (Moirang College, Manipur, India) *Frequency modulation of shear waves in liquids under a magnetic field* (p. 294)
12.45–13.00 ZHILIN, Pavel A (The St Petersburg State Tech. University, Russia) *Multi-spin continuum mechanics and modified electrodynamics* (p. 332)

11.00 – 13.00 Contributed Presentations: Posters

P-3 David Hume Tower, Lower Foyer
Posters III

KIRKEGAARD, Peter (Risø National Laboratory, Roskilde, Denmark) *Numerical simulation of chemical reaction systems: CHEMSIMUL* (p. 278)
IVANOV, Anatoli F (Department of Mathematics, Pennsylvania State University, USA) *Stable solutions of differential delay models* (p. 273)
ROOSE, Dirk (Dept. of Computer Science, K U Leuven, Belgium) *Travelling pulse solutions and their stability in anisotropic media* (p. 304)
CHERNIHA, Natalia D (Institute of Mathematics, Ukrainian Acad. Sci., Ukraine) *Exact solutions of nonlinear boundary value problems with moving boundaries* (p. 247)
GRUNDY, Robert E (School of Mathematical Sciences, University of St Andrews, UK) *Blow-up solutions of the Navier Stokes equations* (p. 265)
HOÀNG, Viêt Hà (Department of Applied Mathematics and Theoretical Physics, University of Cambridge, UK) *Singularly perturbed Dirichlet problems in domains perforated randomly by holes of different sizes* (p. 270)
KOHNO, Toshiyuki (Okayama Univ. of Science, Japan) *On the generalized modified Gauss-Seidel method* (p. 278)
LE BRIZAUT, Jean-Sebastien (ECN, BP, Nantes Cedex, France) *A solution of mixed partial differential equations* (p. 283)
PORUBOV, Alexey V (Institute of High-Performance Computing and Databases, St Petersburg, Russia) *Exact solutions of nonlinear modulation equations* (p. 299)
FRONTINI, Gloria L (University of Mar del Plata-Intema, Argentina) *Combining measurements to improve the solution of an inverse problem in polymer latex characterization* (p. 260)
SIDOROV, Denis N (Institute of Energy Systems SB RAS, Russia) *About integral model of nonlinear dynamic systems* (p. 310)
CHERNYAK, Arkadi A (Belarus State University, Belarus) *Universal reliability graph model of cyclic networks* (p. 248)
KASYANOV, Victor N (Institute of Informatics Systems, Russia) *Support tools for supercomputing* (p. 276)
POZDNIAKOV, Vladimir (Institute of Numerical Simulation, Russia) *Resolution of ecogeophysics problems on the base of focusing transformation of seismic multioffset data* (p. 299)
SIMUS, Nathalia A (Lomonosov Moscow State University, Russia) *Mathematical modelling of porous media strain - stressed state occasioned by fluid injection* (p. 311)
CAPUTO, Barbara (Universita' la Sapienza, Caspur, Italy) *Morphological analysis of mammographic images with Gabor transform and neural network* (p. 245)
TANAKA, Atsushi (Computing Service Center, Yamagata University, Japan) *A statistical approach to the travelling salesman problem* (p. 316)
KOVTUN, Irina I (National Agricultural University, Kiev, Ukraine) *The systems of differential equations with non-Gaussian stochastic perturbations* (p. 280)
DUDZIAK, Marian (Poznan University of Technology, Institute of Combustion Engines and Machine Construction Foundations, Poznan, Poland) *Finite deformations and limit load of elastomer elements* (p. 255)
STRYGINA, Sofia O (Voronezh State Agricultural University, Russia) *Dynamics of relationships between several clinical characteristics of patients affected miocardial infarction* (p. 314)

ICIAM 99
5 - 9 July 1999

Thursday, 8 July, Afternoon Session
Overview

	14.00 – 14.45 Plenary Lectures	
	Jack J DONGARRA, *Scalable High-Performance Libraries in Linear Algebra (EPCC Lecture)*	WRB-8
	H K MOFFATT, *Vortex Structures in Turbulent Flow*	MH
	Stefan MÜLLER, *Magnetic Microstructures - an Example of Multiscale Phenomena*	GS
	14.55 – 15.40 Plenary Lectures	
	Siamak HASSANZADEH, *Java Grande: A Framework for High-End Computing in the "Information Utility" Era (EPCC Lecture)*	WRB-8
	Leah KESHET, *Mathematical Biology inside the Cell*	GS
	S KIDA, *Computational Analysis of Turbulence: Description by Low-Pressure Vortices*	MH
	16.00 – 18.00 Mini-Symposia	
MSP-038	The Motion of Systems Containing Rigid and Elastic Bodies in Resisting Continuum II	AFB-19
MSP-062	Mathematical Methods in Solid Mechanics IV	DHT-C
MSP-066	Mathematics Applied to Quantum Chemistry: Theoretical, Computational and Experimental Aspects IV	DHT-4.01
MSP-073	Analytical and Numerical Methods in Nonlinear Optics	WRB-10
MSP-084	Dynamical Systems in Manufacturing II	AT-8
MSP-091	Applied Ill-Posed Problems	AT-2B
MSP-116	Some "Singular" Aspects of Electromagnetism	DHT-N
MSP-129	Nonlinear Conservation Laws II	AT-6
MSP-134	Mathematical Modelling of Tumour Growth, Angiogenesis and Invasion II	WRB-1
MSP-147	New Challenges in Shape Optimization and Optimal Design II	AFB-10
MSP-156	Typical Projects in a New Branch of Mathematical Research and Education II	AT-3
MSP-162	Analytical and Numerical Methods for Variational Image Processing II	DHT-3.01
MSP-167	Simulation and Models in Kinetic Theory II	WRB-9
MSP-173	Recents Developments of Mixed Finite Element Methods II	AT-5
MSP-179	Identification of Nonlinearities in Flow and Transport Problems	DHT-B
MSP-182	Mathematical Approaches to the Control of Fluid Flow II	AT-2
MSP-194	Numerical Methods for Singular Free Boundary Problems II	AT-4
MSP-214	Nonlinear Waves I	WRB-2
MSP-234	Advances in Numerical Simulation for Industrial Designs of Electronic Circuits	MS-1
MSP-247	Applying Probability and Statistics in Cryptographic Analysis	MS-3
MSP-259	Two-Phase Flows and Sedimentation II	AT-1
MSP-274	The Future of High Performance Computing: Towards Petaflops (EPCC Mini-Symposium)	WRB-8
MSP-275	Climate and Environmental Modelling (EPCC Mini-Symposium)	WRB-11
MSP-277	Tutorial: An Introduction to OpenMP (EPCC Mini-Symposium)	WRB-4
	16.00 – 18.00 Contributed Presentations: Lectures	
C-21	Electromagnetics and Semiconductors II	AFB-13
C-22	Mathematics In Industry II	AFB-14
C-27	Dynamical Systems 2	AFB-18

C-28	Inverse Problems and Control Theory	AFB-17
C-44	Material Science and Solid Mechanics	AT-2.A2
C-45	Fluid and Solid Mechanics	AT-2D
C-46	Numerical Methods and Modelling	WRB-3
16.00 – 18.00 Contributed Presentations: Posters		
This is the continuation of the morning session, see p. 135		

Also this evening		
20.00 – 21.30	**Film Evening**, see p. 220	George Square Lecture Theatre

Thursday, 8 July, Afternoon Session
Details

14.00 – 14.45 Plenary Lectures

Plenary Lecture — William Robertson Building, Lecture Theatre 8

Jack J DONGARRA (Oak Ridge National Laboratory and University of Tennessee, USA)

Scalable High-Performance Libraries in Linear Algebra (EPCC Lecture)

Chair: Sir Michael ATIYAH (Edinburgh University, UK)

High quality portable numerical libraries have existed for many years. These libraries, such as LAPACK, LINPACK and EISPACK, were designed to be accurate, robust, efficient and portable in a Fortran environment of conventional uniprocessors, diverse floating point arithmetics, and limited input data structures. These libraries are no longer adequate on modern parallel high-performance computer architectures. We describe their inadequacies and how we are addressing them in the design of a scalable high-performance library. We shall will look at how the new architectures lead to important changes in the goals as well as the methods of library design.

Plenary Lecture — McEwan Hall

H K MOFFATT (Isaac Newton Institute, Cambridge, UK)

Vortex Structures in Turbulent Flow

Chair: P C CHATWIN (Sheffield University, UK)

Since the time of Lord Kelvin, it has been recognised that an understanding of the dynamics of vortices is the key that may open the door to that most intractable problem, the problem of turbulence. In an inviscid fluid, vortex lines are 'frozen' in the fluid, and consequently all topological properties of the vorticity field are conserved. Techniques based on subtle analogies with the magnetohydrodynamics of perfectly conducting fluids may be used to demonstrate the existence of steady solutions of the Euler equations of arbitrarily complex topology; these solutions in general contain vortex sheets within their structure, and are prone to instabilities of Kelvin-Helmholz (K-H) type. The K-H instabilities give rise to spiral structures which are progressively stretched until viscous effects intervene and establish a 'Burgers' vortex. Each such vortex is subject to the strain field induced by all other vortices, a description that has been convincingly demonstrated for the case of two-dimensional turbulence. The outstanding problem that remains concerns the interaction of skewed vortices or vortex structures in three dimensions. This process may lead to blow-up of solutions of the Euler (and Navier-Stokes) equations, i.e. to the development of singularities of vorticity at finite time, a phenomenon that has a clear bearing on the problem of intermittency in turbulent flow. These aspects of turbulence will be reviewed in this lecture.

Plenary Lecture George Square Lecture Theatre

Stefan MÜLLER (Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany)

Magnetic Microstructures - an Example of Multiscale Phenomena

Chair: I FONSECA (Carnegie Mellon University, USA)

Ferromagnetic materials display a fascinating variety of magnetisation microstructures on many different scales. Understanding the formation and the overall effects of these structures is crucial for a number of key technology applications. At the same time the analysis of magnetic microstructures is an excellent model problem to develop new mathematical tools for the understanding of multiscale phenomena that are ubiquitous in science.

In this talk I will review some of the mathematical challenges in magnetic microstructures and report recent progress in three areas: rigorous scaling laws, thin film limits and compactness results.

Magnetic microstructures arise as minimisers of a simple-looking energy functional that consists of three terms: the anisotropy energy (local, but often nonconvex in the magnetisation), the exchange energy (of harmonic map type) and the energy of the induced magnetic field (quadratic, but nonlocal). Over the last thirty years the applied physics and materials science communities have developed a very good intuition about the possible structure of energy minimisers. Mathematically these suggestions amount to subtle choices of test functions that are expected to provide nearly sharp upper bounds for the energy. What is hardly ever known are lower bounds which would confirm that there is not an even more subtle choice that does substantially better. I will review recent advances regarding lower bounds and optimal scaling laws.

Technologically, thin magnetic films are of particular interest. This complicates the problem by introducing another small length scale but also gives hope to obtain a simplified, two-dimensional theory. There are, however, additional complications in two dimensions, including topological obstructions which are well-known in the study of Ginzburg-Landau theories for vortices. Not surprisingly, most mathematical problems in this area are unsolved. I will discuss the rigorous derivation of a two-dimensional theory in the presence of a weak in-plane applied field (first proposed by Bryant and Suhl) as well as compactness issues that arise in the passage to the two-dimensional limit.

This is joint work with A DeSimone, R V Kohn and F Otto.

14.55 – 15.40 Plenary Lectures

Plenary Lecture — William Robertson Building, Lecture Theatre 8

Siamak HASSANZADEH (Sun Microsystems, USA)

Java Grande: A Framework for High-End Computing in the "Information Utility" Era (EPCC Lecture)

Chair: Sir Michael ATIYAH (Edinburgh University, UK)

The Java language is rapidly being adopted as an environment for Grande Applications. The notion of a Grande Application (GA) is familiar to many in academia and industry but the term is new. In short, a GA is any application, enterprise, technical or industrial, that requires a large number of computing resources, such as those found on the Internet, to solve one or more problems. Examples of Grande Applications are enterprise data management, data mining, financial modeling, product design simulation and analysis, and large-scale scientific and engineering computations, among others. The Java Grande program is motivated by the notion that Java and Jini could be the best possible Grande application development environment and the extensive use of Java could greatly help the large scale computing and communication fields. The goal of the Java Grande is to develop community consensus and recommendations for either enhancement to Java environment or establishment of frameworks for high-end computing in the 'information utility' era.

Plenary Lecture — George Square Lecture Theatre

Leah KESHET (University of British Columbia, Canada)

Mathematical Biology inside the Cell

Chair: I FONSECA (Carnegie Mellon University, USA)

The recent decade has seen an explosive growth in our ability to observe and manipulate subcellular processes. The promise of such experimental biology is that we may be in position to harness our new knowledge to design more effective drugs targeted specifically at diseases such as diabetes, Altzheimer's, or cancer. However, with the incredible complexity of the cell comes a great difficulty in understanding how myriad processes interact, and how they are organized temporally and spatially inside the cell. In my talk, I will highlight a few examples in which mathematical tools and ideas can be brought to bear on these fascinating problems. DIfferential equations, and integro-partial differential equations play a prominent role in my work. Some of this work (with A Mogilner, A Spiros, and G B Ermentrout) addresses the dynamic structural proteins in the cell (actin and other components of the cytoskeleton). Other aspects focus on the intracellular signalling pathways and attempts at understanding their behaviour. The latter work is sponsored by MITACS, under the Natural Sciences and Engineering Research Council of Canada (Networks of Excellence Program).

Plenary Lecture — McEwan Hall

S KIDA (National Institute for Fusion Science, Nagoya, Japan)

Computational Analysis of Turbulence: Description by Low-Pressure Vortices

Chair: P C CHATWIN (Sheffield University, UK)

Turbulence is commonly understood as a chaotic solution of fluid equations. An instantaneous flow field changes randomly both in space and in time, whereas the statistical averages of it generally show somewhat universal characters. In order to propel turbulence researches including prediction of long-term behaviour of the statistical properties and active or passive controls of turbulent flows, it is indispensable to grasp the spatio-temporal structure of the individual flow. In view of difficulty in finding useful analytical solutions of the fluid equations, the computational analysis seems to be the only way to look into the flow structure down to the smallest detail. However, it is not so easy to get a clear picture of the structure of a truly three-dimensional vector field.

Here we present a method of the low-pressure vortices which we have recently introduced as a tool for visualization of flow structure as well as for analysis of turbulence dynamics. It is motivated by those tubular regions of high-vorticity with low pressure at the center which are widely observed in various kinds of turbulence. We develop a numerical code which detects and visualizes the axes and the cores of low-pressure vortices which are defined mathematically. Their temporal evolution gives us the entire picture of three-dimensional structure of turbulence. It is used also to analyse the statistical properties of core size, intensity and length of vortices and to visualize reconnection and merging processes between vortices.

16.00 – 18.00 Mini-Symposia

MSP-038 Adam Ferguson Building, Room 19

The Motion of Systems Containing Rigid and Elastic Bodies in Resisting Continuum II

(see also Part I, MSP-027, p. 120; Part III, MSP-039, p. 155)

Organiser: ILJUKHIN, Alexander A (Pedagogical institute, Taganrog, Russia)

ILJUKHIN, Alexander A (Pedagogical institute, Taganrog, Russia) *Nonlinear phenomenons in one-dimensional theory of elastic rods* (p. 38)
STOROZHEV, Valery I (Donetsk State University, Ukraine) *Dynamic problems of the boundary layer theory for low-symmetric essentially anisotropic bodies, contacted with viscous liquid* (p. 39)
VATULYAN, Alexander O (Rostov State University, Russia) *Boundary integral equations in research of the elastic bodies vibrations* (p. 40)
SHCHEPIN, Nick N (Donetsk Institute of Applied Math and Mechanics, Donetsk, Ukraine) *Modeling of elongated elastic body motion in liquid flow* (p. 39)
KONONOV, Jury N (Donetsk State University, Ukraine) *On stability of unrestricted motion of the system containing connected rigid bodies with liquid filling* (p. 38)

MSP-062 David Hume Tower, Lecture Theatre C

Mathematical Methods in Solid Mechanics IV

(see also Part I, MSP-059, p. 84; Part II, MSP-060, p. 103; Part III, MSP-061, p. 121)

Organisers: KAPLUNOV, Julius D (Institute for Problems in Mechanics, Russia)
WAN, Frederic Y M (University of California, Irvine, USA)

ATLURI, S (University of California, Los-Angelos, USA) *Meshless methods in computational mechanics*
KNOWLES, James K (California Institute of Technology, USA) *Shock-induced phase changes in solids* (p. 65)
STEIGMANN, D (University of California, Berkeley, USA) *On the relationship between the Cosserat and Kirchhoff-Love theories of elastic shells* (p. 66)

MSP-066 David Hume Tower, Room 4.01

Mathematics Applied to Quantum Chemistry: Theoretical, Computational and Experimental Aspects IV

(see also Part I, MSP-063, p. 84; Part II, MSP-064, p. 103; Part III, MSP-065, p. 121)

Organiser: LE BRIS, Claude (Ecole Nationale des Ponts et Chaussées, France)

MENNUCCI, Benedetta (Università di Pisa, Italy) *Quantum mechanical models for systems in solution* (p. 69)
DEFRANCESCHI, Mireille (Commissariat à l'Energie Atomique, France) *Examples of quantum mechanical calculations of condensed phase* (p. 68)
COULAUD, Olivier (Inria-Lorraine & Iecn) *Numerical simulation in biological molecular systems* (p. 68)
LE TALLEC, Patrick (Université Paris Dauphine, France) *Mesoscopic modelling of polymers* (p. 69)

MSP-073 William Robertson Building, Seminar Room 10

Analytical and Numerical Methods in Nonlinear Optics

Organisers: STRUTHERS, Allan A (Michigan Technological University, USA)
SHENG, Qin (Michigan Technological University, USA)

Substantial analytical and numerical progress has been made recently on the nonlinear partial differential equations that arise in nonlinear optics. The physical phenomena described by these equations are vital in optical data transmission and the design of ultra-high speed optical computers. These exciting applications require novel numerical methods and improved analytical understanding of the underlying nonlinear equations. The aim of the minisymposium is to facilitate interaction between researchers and highlight recent analytical and numerical progress in the nonlinear Schrödinger equation, three-wave interaction system, and related equations arising in nonlinear optics.

STRUTHERS, Allan A (Michigan Technological University, USA) *Three wave interaction solitons in optical quadratic frequency conversion processes* (p. 75)
FISHMAN, Louis (Naval Research Laboratory, USA) *Phase space and path integral methods in integrated optics* (p. 75)
FIRTH, William (University of Strathclyde, Glasgow, UK) *Stability, control and manipulation of nonlinear optical patterns* (p. 75)
BOARDMAN, Allan D (University of Salford, UK) *Dynamics of non-Kerr solitons - A new approach* (p. 75)
SHENG, Qin (University of Southwestern Louisiana, USA) *On a spline collocated difference method for the nonlinear Schrödinger equation* (p. 75)

MSP-084 Appleton Tower, Seminar Room 8

Dynamical Systems in Manufacturing II

(see also Part I, MSP-083, p. 122; Part III, MSP-085, p. 155; Part IV, MSP-266, p. 171)

Organisers: BLACKMORE, Denis (New Jersey Institute of Technology, USA)
SAMOILENKO, Anatoliy M (Institute of Mathematics, National Academy of Sciences, Ukraine)
PRYKARPATSKY, Anatoliy K (AGH, Poland and Dept. of Nonlin. Mathem. Analysis, IAPMM of the NAS, Lviv, Ukraine)

PRYKARPATSKY, Anatoliy K (AGH, Poland and Dept. of Nonlin. Mathem. Analysis, IAPMM of the NAS, Lviv, Ukraine) *On the structure of the Lax type formula to the nonlinear Hamilton-Jacobi equations and some its applications* (p. 85)
PRYTULA, Mykola M (Lviv State University, Ukraine) *On nonuniform and nonlocal conservation laws of the KdV-equation* (p. 85)
SAMOYLENKO, Valeriy H (Kyiv Taras Shevchenko University, Ukraine) *Specific effects caused by impulse influences in impulsive systems* (p. 86)
BOGOLIUBOV, Nickolay N (Dept. of Statistical Mechanics at the Steklov Mathematical Institute of the RAN, Russia) *Hartree-Fock-Bogoliubov approximation for model systems with four-fermion interaction* (p. 83)

MSP-091 Appleton Tower, Room 2B

Applied Ill-Posed Problems

Organiser: YAGOLA, Anatoly (Faculty of Physics, Moscow State University, Moscow, Russia)

We intend to present new results and numerical methods for the solution of applied linear and nonlinear ill-posed problems in vibrational spectroscopy, astrophysics, etc. The possible topics for consideration on the Mini-symposium are following: 1) a priori information for ill-posed problems; 2) iterative methods; 3) numerical implementation.

ALIEV, Baymurod (Tajik State National University) *Linear ill-posed problems in spectrum* (p. 92)
ISKENDEROV, Asaf Dashdamir (Dept. of Optimization and Control, Baku State University, Azerbaydzhan) *Iterative regularization of the problem about determination of the memory kernel* (p. 92)
KURAMSHINA, Gulnara (Faculty of Chemistry, Moscow State University, Moscow, Russia) *Inverse problems of vibrational spectroscopy* (p. 92)
YAGOLA, Anatoly (Faculty of Physics, Moscow State University, Moscow, Russia) *Ill-posed problems and a priori information* (p. 92)
KISS, Eva Maria (Department of Materials Sciences, Freiberg University of Mining and Technology, Germany) *Identification of memory kernels in viscoelasticity - a comparison of three regularization techniques with discretization and numerical examples* (p. 92)

MSP-116
Some "Singular" Aspects of Electromagnetism

David Hume Tower, Faculty Room North

Organiser: LOHRENGEL, Stephanie (ENSTA/UMA, France)

This mini-symposium wants to focus on some recent advances in the analysis of singularities within the frame of Maxwell's equations. Indeed, the singular behaviour of the electromagnetic field in the neighbouring of edges and corners causes difficulties for the application of classical mathematical theories and the numerical simulation. Current research work has been done on inverse or scattering problems as well as on the analysis of superconductive microstrips, and new numerical methods show how to overcome the above-mentioned difficulties. The mini-symposium is intended to any scientist interested in the origins of singular fields and the different ways to handle them.

LOHRENGEL, Stephanie (ENSTA/UMA, France) *How to handle singularities of the electromagnetic field in regions with corners by nodal finite elements* (p. 113)
KANGRO, Urve (Tartu University, Estonia) *Singularities of extensions of solutions of Helmholtz's equation* (p. 113)
RAMDANI, Karim (UMA Laboratory, ENSTA, France) *Singularities of non elliptic transmission problems: Application to the analysis of a superconductive micro-strip line* (p. 113)
CIARLET, Patrick P, Jr (ENSTA/UMA, France) *Solving numerically the time-dependent Maxwell equations in domains with reentrant corners* (p. 113)

MSP-129
Nonlinear Conservation Laws II

Appleton Tower, Seminar Room 6

(see also Part I, MSP-128, p. 123)

Organisers: TRIVISA, Konstantina (Northwestern University, USA)
CHEN, Gui-Qiang (Northwestern University, USA)

CHEN, Gui-Qiang (Northwestern University, USA) *Existence, compactness, and asymptotic behavior of entropy solutions* (p. 124)
FREISTÜHLER, Heinrich (RWTH Aachen, Germany) *Stability and instability of viscous and inviscid shock waves in one or several space dimensions* (p. 124)
NATALINI, Roberto (Istituto per le Applicazioni del Calcolo, CNR, Italy) *The Barenblatt non-equilibrium model for secondary oil recovery* (p. 124)
SERRE, Denis A G (Ecole Normale Supérieure de Lyon, France) *On the multi-D stability of some large planar shock waves* (p. 124)
HOLDEN, Helge (Norwegian University of Science and Technology, Norway) *Operator splitting and the generalized KdV equation* (p. 124)

MSP-134
Mathematical Modelling of Tumour Growth, Angiogenesis and Invasion II

William Robertson Building, Seminar Room 1

(see also Part I, MSP-133, p. 123)

Organiser: CHAPLAIN, Mark A J (University of Dundee, UK)

ANDERSON, Alexander A R (University of Dundee, UK) *Continuous and discrete mathematical models of tumour angiogenesis* (p. 127)
CHAPLAIN, Mark A J (University of Dundee, UK) *Continuous and discrete models of tumour cell invasion* (p. 128)
SHERRATT, Jonathan A (Dept of Mathematics, Heriot-Watt University, Edinburgh, UK) *Mathematical modelling of tumour invasion: Basic mechanisms and therapeutic implications* (p. 128)
PANETTA, John C (Penn State Erie, The Behrend College, USA) *Mathematical modelling of cell-cycle-specific chemotherapeutic drug regimens for cancer* (p. 128)
CAMERON, David A (Department of Oncology, University of Edinburgh, UK) *Clinical aspects of modelling cancer growth* (p. 128)

MSP-147 Adam Ferguson Building, Room 10
New Challenges in Shape Optimization and Optimal Design II
(see also Part I, MSP-146, p. 125)

Organisers: CAGNOL, John (Ecole des Mines de Paris, France)
ZOLÉSIO, Jean-Paul (Ecole des Mines de Paris et CNRS, France)

BUCUR, Dorin (CNRS, France) *Concentration-compactness principle and shape optimization* (p. 138)
EPPLER, Karsten (Universitat Chemnitz, Germany) *Sufficient optimality conditions and applications to some shape optimization problems* (p. 138)
GOMEZ, Nicolas (Ecole des Mines de Paris, France) *Asymptotic behavior for the shape differential equation* (p. 139)
HÖMBERG, Dietmar (Weierstraß Institute for Applied Analysis and Stochastics, Germany) *State constraint optimal control of laser surface treatments* (p. 139)

MSP-156 Appleton Tower, Lecture Theatre 3
Typical Projects in a New Branch of Mathematical Research and Education II
(see also Part I, MSP-155, p. 126)

Organiser: BUNSE-GERSTNER, Angelika (Zentrum fuer Technomathematik, Fachbereich 3/ Mathematik und Informatik, Universität Bremen, Germany)

BENNER, Peter (Zentrum für Technomathematik, Mathematik und Informatik, Universität Bremen, Germany) *NICONET, a European network for numerically reliable software in computer-aided control systems design* (p. 145)
LANG, Patrick (ITWM, Germany) *Model reduction and robust filter design for elastomechanical systems* (p. 146)
WEISS, Martin G (ITWM Kaiserslautern, Germany) *Regulation thermography and long-term ECGs: Mathematics for diagnosis aiding in medicine* (p. 147)
BUNSE-GERSTNER, Angelika (Zentrum für Technomathematik, Fachbereich 3/ Mathematik und Informatik, Universität Bremen, Germany) *Numerical steady state analysis of electronic circuits driven by multi-tone signals* (p. 146)

MSP-162 David Hume Tower, Room 3.01
Analytical and Numerical Methods for Variational Image Processing II
(see also Part I, MSP-161, p. 126)

Organisers: SPITALERI, Rosa Maria (Istituto per le Applicazioni del Calcolo-CNR, Roma, Italy)
MARCH, Riccardo (Istituto per le Applicazioni del Calcolo-CNR, Roma, Italy)

CHAN, Tony F (University of California, Los Angeles, Department of Mathematics, USA) *Reduced Mumford-Shah models for image segmentation* (p. 150)
FINZI VITA, Stefano (Università di Roma La Sapienza, Rome, Italy) *A Cahn-Hilliard evolution for planar curves in shape modeling* (p. 150)
SPITALERI, Rosa Maria (Istituto per le Applicazioni del Calcolo, Rome, Italy) *Multigrid finite difference solution of Euler equations for variational image segmentation* (p. 151)

MSP-167 William Robertson Building, Seminar Room 9
Simulation and Models in Kinetic Theory II
(see also Part I, MSP-166, p. 127)

Organisers: LAMPIS, Maria (Dipartimento di Matematica del Politecnico di Milano, Italy)
CERCIGNANI, Carlo (Dipartimento di Matematica del Politecnico di Milano, Italy)

AOKI, Kazuo (Kyoto University, Japan) *Numerical analysis of a rarefied gas flow induced near the edges of a uniformly cooled or heated plate* (p. 155)
SONE, Yoshio (Department of Aeronautics and Astronautics, Graduate School of Engineering, Kyoto University, Japan) *Bifurcation and stability in the cylindrical couette rarefied gas flow with evaporation and condensation* (p. 156)
FREZZOTTI, Aldo (Dipartimento di Matematica, Politecnico di Milano, Italy) *DSMC simulation of granular flows in planetary rings* (p. 155)
ALEXANDRE, Radjesvarane (Universite d'orleans France) *Around Boltzmann equation without cutoff* (p. 155)

MSP-173 Appleton Tower, Lecture Theatre 5
Recents Developments of Mixed Finite Element Methods II
(see also Part I, MSP-172, p. 128)

Organiser: THOMAS, Jean-Marie (University of Pau, France)

GATICA, Gabriel N (Departamento de Ingeniería Matemática, Universidad de Concepción, Concepción, Chile) *On the coupling of mixed-FEM and BEM* (p. 160)
TSOGKA, Chrysoula (INRIA, France) *Analysis of a new family of mixed finite elements for elasticity* (p. 161)
BOFFI, Daniele (Penn State University, University Park, PA 16802, USA) *Mixed finite elements in the approximation of the eigenvalues of the Maxwell's equations* (p. 160)
TRUJILLO, David (Universite de Pau, France) *Solving drying problem by mixed finite volume method* (p. 161)

MSP-179 David Hume Tower, Lecture Theatre B
Identification of Nonlinearities in Flow and Transport Problems

Organisers: KNABNER, Peter (University of Erlangen-Nuremberg, Germany)
DUCHATEAU, Paul (Colorado State University Fort Collins, USA)

Often constitutive laws and material functions entering partial differential equation models for flow and transport problems are not accessible by direct measurements: They are to be identified from additional observations of the system. Such inverse problems are usually ill-posed in the sense that the identifiability of the unknown from (error-free) observations is questionable or there is no continuous dependence on the observation in appropriate norms. The first aspect is related to the question of experiment design (to avoid this deficiency), the second one to the design of stable algorithms for the numerical solution. These topics will be addressed both in a general framework and also for specific models from applications.

DUCHATEAU, Paul (Colorado State University, USA) *The abstract structure of coefficient-inverse problems* (p. 166)
GOTTLIEB, Johannes (University of Karlsruhe, Germany) *Hysteresis identification for porous media flow* (p. 166)
KNABNER, Peter (University of Erlangen-Nuremberg, Germany) *Identifiability of adsorption characteristics in porous media flow and experiment design* (p. 166)
SPIVACK, Mark (University of Cambridge, UK) *Identification of source term in a coastal evolution equation* (p. 166)

MSP-182 Appleton Tower, Lecture Theatre 2
Mathematical Approaches to the Control of Fluid Flow II
(see also Part I, MSP-181, p. 129)

Organiser: HINZE, Michael (Fachbereich Mathematik, Technische Universität Berlin, Germany)

CHOI, Haecheon (Department of Mechanical Engineering, Seoul National University, Korea) *Suboptimal feedback control of vortex shedding* (p. 167)
VOLKWEIN, Stefan (Institut für Mathematik, Karl-Franzens Universität Graz, Austria) *Approximations of optimal control problems by proper orthogonal decomposition* (p. 168)
HINZE, Michael (Karl-Franzens Universität Graz, Austria and Technische Universität Berlin, Germany) *Constructing feedback laws for fluid flows* (p. 167)
COLLIS, S Scott (Rice University, Houston, Texas, USA) *Large eddy simulation of active turbulence control* (p. 167)

MSP-194 Appleton Tower, Lecture Theatre 4

Numerical Methods for Singular Free Boundary Problems II

(see also Part I, MSP-193, p. 129)

Organiser: FALCONE, Maurizio (Dipartimento di Matematica, Universita' di Roma "La Sapienza", Roma, Italy)

MERRIMAN, Barry (University of California at Los Angeles, USA) *Level set methods for modeling epitaxial growth of semiconductor devices* (p. 177)
FIERRO, Francesca (Dipartimento di Matematica, Università di Milano, Italy) *Numerical approximation of mean curvature flow with a forcing term* (p. 177)
CHAMBOLLE, Antonin (CEREMADE, Université de Paris-Dauphine, France) *Discrete approximations and numerical computations for the Mumford-Shah functional* (p. 176)
MASNOU, Simon (CEREMADE, Université Paris-Dauphine, Paris, France) *Image singular interpolation* (p. 177)

MSP-214 William Robertson Building, Seminar Room 2

Nonlinear Waves I

(see also Part II, MSP-215, p. 160; Part III, MSP-216, p. 169)

Organisers: CHEN, Min (Penn State University and University of Texas at Austin, USA)
BONA, Jerry (Univercity of Texas, Austin, USA)

This session is centered around nonlinear wave propagation in the presence of dispersion and dissipation. The session will emphasize especially problems arising in describing water waves in laboratory and field situations. Both surface waves and internal waves will be a focus of the discussions. The particular presentations will be concerned with the study of the KP-equation and some alternatives, the stochastic KdV equation, systems of equations for the two-way propagation of water waves, and others. Featured in the session will be theoretical work, numerical analysis, implementation of numerical schemes and the use of these schemes to better understand the models, reports on laboratory experiments and comparisons of model predictions with real-world data. The subject is important both as a fundamental area in fluid mechanics and for its applications in oceanography, meteorology, astrophysics and other areas of science and engineering.

SCHONBEK, Maria (Dept of Mathematics, University of California, Santa Cruz, USA) *To be advised*
SMITH, Ronald (Loughborough University, UK) *Alternatives to the Kadomtsev Petviashvili equations for shallow water waves* (p. 193)
TOM, Michael M (Louisiana State University, Baton Rouge, USA) *A regularized long wave-KP equation* (p. 193)
TEMAM, Roger (Indiana University, Bloomington, USA) *TBA*

MSP-234 Management School, Lecture Theatre 1

Advances in Numerical Simulation for Industrial Designs of Electronic Circuits

Organisers: GÜNTHER, Michael (TU Darmstadt, Fachbereich Mathematik, Germany)
FELDMANN, Uwe (Siemens AG München, Germany)

Microelectronics is a core technology for numerous industrial innovations. Progress has been achieved by extensive use of computer simulation techniques, especially circuit simulation. Most of the applications of circuit analysis programs for computer-aided electronics-design (CAE) of circuits are performed in the time domain. The automatic modeling approach used preserves the topological structure of the network and does not aim at systems with a minimal set of unknowns. This results in systems of differential-algebraic equations (DAEs). Research at industry aims mainly at enhancing the numerical kernel in the following fields: - item to cope with numerical problems caused by higher index problems; - to accelerate simulation by exploiting special properties of the systems to be analyzed (like multi-rate behaviour or partial decoupling), and by parallelization; - to handle efficiently parasitic effects (due to interconnect, noise, thermal coupling, ...), which become more and more important; - to consider circuits as nonlinear dynamical systems, such offering new analysis capabilities like stability and bifurcation analysis, startup behavior and looking at the region of attraction.
This subject is strongly linked with mini-symposium MSP-144 "Mathematical Problems in Circuit Simulation", where some of these problems are treated more from the viewpoint of numerical analysis. In this mini-symposium we focus on industrial aspects: the advancements are pointed out achieved by three joint projects, which are performed by three academics research groups in cooperation with the circuit simulation group at Siemens Research Lab München. These projects are sponsored by the German Federal Ministry of Education, Science, Research and Technology within the program "Mathematical methods for solving problems in industry and economy".

GÜNTHER, Michael (TU Darmstadt, Fachbereich Mathematik, Germany) *Numerical integration methods adapted for electric circuit simulation packages* (p. 205)
ESTEVEZ SCHWARZ, Diana (Humboldt-University of Berlin, Germany) *Consistent initialization of differential-algebraic equations in circuit simulation* (p. 204)
SCHWARZ, Angela (Technische Universität München, Germany) *Modeling and simulation of high-frequency quartz oscillators* (p. 205)
FELDMANN, Uwe (Siemens AG München, Germany) *Industrial applications of the new algorithms* (p. 204)

MSP-247 Management School, Lecture Theatre 3
Applying Probability and Statistics in Cryptographic Analysis

Organiser: MITCHELL, Christopher J (Information Security Group, Royal Holloway, University of London, UK)

Cryptography is now widely used in providing security for vital information communications tasks. However, the mathematics of many widely used cryptographic primitives is not properly understood, and recent applications of statistical and probabilistic techniques have revealed unexpected weaknesses in widely used techniques. These attacks are the main focus of this mini-symposium, in which two well-established researchers in the area present the latest cryptanalytic results. A short introduction to the area will be provided, and it is intended that the mini-symposium be accessible to all those with a basic working knowledge of probability and statistics.

MITCHELL, Christopher J (Information Security Group, Royal Holloway, University of London, UK) *Mathematics of cryptanalysis - A brief introduction* (p. 213)
MURPHY, Sean (Royal Holloway, University of London, UK) *Statistical techniques in cryptography* (p. 213)
PRENEEL, Bart (Katholieke Universiteit Leuven, Dept. Electrical Eng.-ESAT/COSIC, Belgium) *Birthday attacks on cryptographic primitives* (p. 213)

MSP-259 Appleton Tower, Lecture Theatre 1
Two-Phase Flows and Sedimentation II
(see also Part I, MSP-258, p. 130)

Organiser: WENDLAND, Wolfgang L (University of Stuttgart, Germany)

EVJE, Steinar (University of Bergen, Norway) *Finite difference schemes for degenerate convection-diffusion equations with applications in simulation of sedimentation processes* (p. 220)
KARLSEN, Kenneth H (Department of Mathematics, University of Bergen, Norway) *Numerical methods for the simulation of the settling of flocculated suspensions* (p. 220)
TORY, Elmer M (Mount Allison University, Canada) *Stochastic simulation of sedimentation* (p. 221)
HESSE, Christian (Mathematics Institute A, University of Stuttgart, Germany) *A new methodology for modeling particle sedimentation in fluids* (p. 220)

MSP-274 William Robertson Building, Lecture Theatre 8
The Future of High Performance Computing: Towards Petaflops (EPCC Mini-Symposium)

Organisers: SIMPSON, Alan D (EPCC, The University of Edinburgh, UK)
KENNEDY, Anthony D (Maxwell Institute, The University of Edinburgh, UK)

The fastest computers created today are capable of speeds of about a teraflop — a trillion operations per second. There are, however, numerous applications areas — particularly within physical modelling — that seek still faster processing speeds. Efforts are, therefore, now being made in developing Petaflops Computers with a thousand trillion operations per second. These speeds are, however, limited by the memory storage and transference rates. Additionally, Massively Parallel computers are required to enable such rapid operations. This mini-symposium focuses upon the potential uses and implications of Petaflops Computers within the Scientific Community and provides viewpoints of recent and future developments from a user, a researcher using a custom-built machine and a major vendor. Recent achievements in Astrophysical Simulation and other areas of Applied and Modelling Science are presented and the tremendous opportunities that Petaflops computing may offer are discussed.

HEGGIE, Douglas (Mathematics, The University of Edinburgh, UK) *Status of the GRAPE (GRAvity PipEline) project* (p. 230)
RALSTON, Ben (IBM, UK) *ASCI Blue Pacific: Teraflops computing*
CATLOW, Richard (The Royal Institution of Great Britain, UK) *UK scientific computing in the Petaflop Era* (p. 230)

MSP-275 William Robertson Building, Seminar Room 11

Climate and Environmental Modelling (EPCC Mini-Symposium)

Organisers: SIMPSON, Alan D (EPCC, The University of Edinburgh, UK)
DARLING, Gordon (EPCC, The University of Edinburgh, UK)

Weather Prediction, Climate Forecasting and Ocean Circulation Modelling are established and associated application areas of High Performance Computing techniques. In each case, enormous importance is attached to the accuracy and appropriateness of the underlying models and their underpinning assumptions. Clear benefits arise from the integration of models but these are limited by the volume of data that must be handled, the computational intensity of calculations and the practicalities of integration. Within this mini-symposium the format of existing models and how to improve them is examined, together with the requirement for High Performance Computing techniques in determining meaningful solutions. Practical issues such as Load Balancing and Code Optimisation are examined and the enhanced benefits of improved forecasting and predictions are demonstrated.

PALMER, Tim (European Centre for Medium-Range Weather Forecasts (ECMWF), UK) *Predicting uncertainty in weather and climate forecasts* (p. 230)
SMITH, Douglas A (EPCC, The University of Edinburgh, UK) *Increasing the efficiency of the UK Meteorological Office unified model* (p. 230)
HAINES, Keith (Meteorology, The University of Edinburgh, UK) *Global ocean circulation modelling using satellite data* (p. 230)

MSP-277 William Robertson Building, Seminar Room 4

Tutorial: An Introduction to OpenMP (EPCC Mini-Symposium)

Organisers: SIMPSON, Alan D (EPCC, The University of Edinburgh, UK)
BULL, Mark (EPCC, The University of Edinburgh, UK)

An increasing number of parallel machines make use of the shared memory architecture. In this class of platform each processor has access to a global memory store, and processors communicate with one another by accessing the same shared memory. This communication paradigm simplifies programming multiprocessor machines by removing the requirement for explicit communications. Parallelisation of shared memory programs is mainly carried out using compiler directives. Until recently each manufacturer provided their own set of machine specific compiler directives which, while similar in style and functionality, meant that programs were not trivially portable. The OpenMP standard was designed to address this issue and to provide a standard interface to shared memory architectures. This tutorial looks at the techniques for parallelising programs, written in either Fortran or C, using OpenMP.

BULL, Mark (EPCC, The University of Edinburgh, UK) *Basic Concepts of OpenMP* (p. 231)
HENTY, David S (EPCC, The University of Edinburgh, UK) *Parallel Regions and Synchronisation* (p. 231)
GRAHAM, Paul (EPCC, The University of Edinburgh, UK) *Parallel Loops* (p. 231)

16.00 – 18.00 Contributed Presentations: Lectures

C-21 Adam Ferguson Building, Room 13

Electromagnetics and Semiconductors II

Chair(s): BOSSAVIT; RADZIUNAS

16.00–16.15 HSU, Jyh-Ping (Department of Chemical Engineering, National Taiwan University, China) *Stability of a colloidal dispersion: charge regulation/adsorption model* (p. 271)

16.15–16.30 VERNHET, Laurent (Université de Pau et des Pays de l'Adour, Pau, France) *Solution of the Maxwell system with a generalized impedance boundary condition* (p. 322)

16.30–16.45 BOSSAVIT, Alain (Électricité de France) *Yee scheme, FDTD, Whitney forms: A new synthesis* (p. 242)

16.45–17.00 MUSCATO, Orazio (Dipartimento di Matematica, Universita' di Catania, Italy) *Check of the consistency of carrier transport models in semiconductor devices with the Onsager reciprocity principle* (p. 291)

17.00–17.15 TSENG, Shiojenn (TamKang University, Taiwan) *Evaluation of the surface and line integrals of some special functions* (p. 318)

17.15–17.30 KANAYAMA, Hiroshi (Kyushu University, Japan) *A finite element approach for 3-D eddy current problems* (p. 275)

17.30–17.45 RADZIUNAS, Mindaugas (Weierstrass Institute for Applied Analysis and Stochastics (WIAS), Berlin, Germany) *Hysteresis phenomenon in numerical simulations of multisectional DFB semiconductor lasers* (p. 302)

17.45–18.00 GARCIA-REIMBERT, Catherine (IIMAS-UNAM, Mexico) *Evolution of a hotspot in a cylindrical dielectric material heated by microwaves* (p. 261)

C-22 Adam Ferguson Building, Room 14

Mathematics In Industry II

Chair(s): STOCKIE; MYERS

16.00–16.15 FELTHAM, Daniel L (UMIST, UK) *Solidification of spheres with application to emulsions* (p. 259)

16.15–16.30 HOCKING, Graeme C (Murdoch University, Perth, Australia) *Modelling an ultrasonic nebulizer* (p. 270)

16.30–16.45 STOCKIE, John M (Department of Mathematics and Statistics, Simon Fraser University, Burnaby, Canada) *Modeling gas transport in porous electrodes* (p. 314)

16.45–17.00 CLEARY, Paul W (CSIRO Mathematical and Information Sciences, Australia) *The importance of particle shape in granular flow modelling* (p. 248)

17.00–17.15 CHARPIN, Jean P F (Applied Mathematics and Computing Group, Cranfield University, UK) *Numerical solution for coupled ice growth and water flow* (p. 247)

17.15–17.30 KOSTINA, Ekaterina (IWR, University of Heidelberg, Germany) *Robust parameter estimation for dynamic systems* (p. 280)

17.30–17.45 MYERS, Tim G (Applied Mathematics and Computing Group, Cranfield University, UK) *A supercooled Stefan problem relevant to aircraft icing* (p. 291)

17.45–18.00 KALMÁR-NAGY, Tamás (Cornell University, Ithaca, USA) *Delay oscillators with high frequency excitation* (p. 275)

C-27 Adam Ferguson Building, Room 18

Dynamical Systems 2

Chair(s): HOGAN; KUTZ

16.00–16.15 KOZIEN, Marek S (Cracow Univesity of Technology,Poland) *Influence of the angle of coupling on vibrational energy transmission for the jointed plate-like elements* (p. 280)
16.15–16.30 GOLUBITSKY, Marty (University of Houston, USA) *Animal gaits and coupled oscillators* (p. 263)
16.30–16.45 HOGAN, S John (University of Bristol, UK) *Local analysis of C-bifurcations in n-dimensional piecewise-smooth dynamical systems* (p. 271)
16.45–17.00 TORRES, María E (National University of Entre Ríos, Engineering Faculty, Argentine) *Integral operators evolution: a new approach by means of q-entropies* (p. 318)
17.00–17.15 HEDRIH, Katica (Faculty of Mechanical Engineering University of Nis, Yugoslavia) *Vectors connected to a point and to an oriented axis or to an oriented plane with applications* (p. 269)
17.15–17.30 KUZMINA, Lyudmila K (Kazan Aviation Institute, Russia) *Models and methods in dynamics of complex systems* (p. 282)
17.30–17.45 KUTZ, J Nathan (Department of Applied Mathematics, University of Washington, USA) *Dynamics, bifurcations, and stability of fronts in the optical parametric oscillator* (p. 282)
17.45–18.00 KHENTOV, Anatoli A (Nizhni Novgorod State University, N Novgorod, Russia) *Resonance regimes in the dynamical systems and the peculiarities of motions for Jupiter's and Saturn's satellites* (p. 277)

C-28 Adam Ferguson Building, Room 17

Inverse Problems and Control Theory

Chair(s): MOUTAZAIM; LUPU

16.00–16.15 EL BADIA, Abdellatif (University of Technology of Compiegne, France) *Some PDE inverse problems from lateral boundary measurements* (p. 257)
16.15–16.30 MIKHAILOV, Sergei E (Wessex Institute of Technology, UK) *Nonlinear functionals interpolation and its application to non-local strength functionals identification* (p. 288)
16.30–16.45 MOUTAZAIM, Fathallah (Genie informatique, Compiegne University, Compiegne, France) *Inverse Stefan problem* (p. 290)
16.45–17.00 GYURKOVICS, Eva (Budapest University of Technology, Hungary) *Nonlinear receding horizon control for discrete-time uncertain systems* (p. 266)
17.00–17.15 MYŚLIŃSKI, Andrzej M (System Researcz Institute, Poland) *Shape optimization of contact problems based on fictitious domain method* (p. 291)
17.15–17.30 JANNO, Jaan (Institute of Cybernetics at Tallinn TU, Estonia) *Lavrent'ev regularization of nonlinear ill-posed problems* (p. 274)
17.30–17.45 LUPU, Gheorghe (Ovidius University, Romania) *The hypergeometric function in the study of collision integral of the Boltzmann's equation* (p. 285)
17.45–18.00 BALASHEVICH, Natalia V (Institute of Mathematics, National Academy of Sciences, Belarus) *Construction of bounded stabilizing feedbacks for dynamical systems* (p. 240)

C-44 Appleton Tower, Room 2.A2

Material Science and Solid Mechanics

Chair(s): BÉDA; ZHANG

16.00–16.15 ROSATO, Vittorio (ENEA, Ente per le Nuove Tecnologie, l'Energia e l'Ambi ente, Italy) *Metacomputing for multi-scale modelling of amorphous semiconductors* (p. 304)
16.15–16.30 KALPAKIDES, Vassilios K (Department of Mathematics, University of Ioannina, Greece) *On the symmetries of non-linear thermoelasticity* (p. 275)
16.30–16.45 BÉDA, Peter B (HAS-TUB Research Group of Dynamics of Machines and Vehicles, Technical University Budapest, Hungary) *Dynamical systems in modelling of material instabilities* (p. 241)
16.45–17.00 DESERI, Luca (Dipartimento di Ingegneria-Universita' di Ferrara, Italy) *On the response of viscoelastic polymers under finite deformations* (p. 254)
17.00–17.15 ZHANG, Wen (Department of Mathematics and Statistics, Oakland University, USA) *Numerical simulation of microstructural evolution in sintering* (p. 331)
17.15–17.30 GIOVINE, Pasquale (Dipartimento di Meccanica dei Fluidi ed Ingegneria Offshore, Universita' di Reggio Calabria, Italy) *Diatomic continua: balance equations and constitutive relations* (p. 263)
17.30–17.45 BULIGA, Marius (Institute of Mathematics of the Romanian Academy, Romania) *Energetic criterions in brittle fracture mechanics* (p. 244)
17.45–18.00 GVOZDOVSKAYA, Natalia (Institute for Problems in Mechanics, Russian Academy of Sciences, Russia) *The structure of quasitransverse waves in a composite - elastic media with internal structure* (p. 266)

C-45
Fluid and Solid Mechanics
Appleton Tower, Room 2D

Chair(s): EGLIT

16.00–16.15 YAKUSHEV, Vladimir L (Institute for Computer Aided Design, Russian Academy of Sciences, Moscow, Russia) *Investigation of prebuckling and postbuckling stable forms of shells in view of initial imperfections* (p. 329)
16.15–16.30 SEMENOV, Artem (St Petersburg State Technical University, Russia) *Computer simulation of zigzag-like fatigue crack growth* (p. 308)
16.30–16.45 EGLIT, Margarita E (Moscow State University, Moscow, Russia) *The effect of weak heat-conductivity on propagation of long acoustic waves in mixtures* (p. 257)
16.45–17.00 GEORGIEVSKII, Dimitri V (Moscow State University, Russia) *The notion of yield stress for tensor non-linear media* (p. 262)
17.00–17.15 ANTIPOV, Yuriy A (University of Bath, UK) *Exact formulae for the weight functions of the 3-d-problem of an interfacial semi-infinite plane crack* (p. 236)
17.15–17.30 No talk
17.30–17.45 No talk
17.45–18.00 No talk

C-46
Numerical Methods and Modelling
William Robertson Building, Seminar Room 3

Chair(s): HACIA; STOJANOVSKI

16.00–16.15 TOLSTYKH, Andrei I (Computing Center, Russian Academy of Sciences, Russia) *On constructing arbitrary-order difference schemes for parallel processing* (p. 317)
16.15–16.30 VLASOV, Vladimir I (Computing Center of Russian Academy of Sciences, Moscow, Russia) *A meshless method for solving boundary value problems in 3D domains of complex shape* (p. 323)
16.30–16.45 HACIA, Lechoslaw (Institute of Mathematics, Poznan Technology University, Poznan, Poland) *On iterative-collocation methods of solving Volterra-Fredholm integral equations* (p. 267)
16.45–17.00 ANTOINE, Marie-Joelle (Laboratoire CERMA, France) *A proposal for the numerical simulation of urban microclimates* (p. 236)
17.00–17.15 IL'ICHEV, Vitaly G (Rostov State University, Russia) *Ecology-evolutionary models: theory and application* (p. 272)
17.15–17.30 ARKIN, Vadim I (Central Economics and Mathematics Institute, Russia) *Investment under stochastic environment* (p. 237)
17.30–17.45 STOJANOVSKI, Vitomir (Faculty of Technical Sciences, St Kliment Ohridski University, Bitola, Macedonia) *Some interpolation methods used during calculations with variable boundary conditions* (p. 314)
17.45–18.00 No talk

ICIAM 99
5-9 July 1999

Friday, 9 July, Morning Session
Overview

	09.00 – 09.45 Plenary Lectures	
	O A OLEINIK, *On Homogenization of Differential Operators*	WRB-8
	Michele PARRINELLO, *Large Scale Ab-Initio Molecular Dynamics: Algorithms and Industrial Applications*	MH
	Y YUAN, *A Review of Trust Region Algorithms for Optimization*	GS
	10.05 – 12.05 Mini-Symposia	
MSP-010	Numerical Methods for Kinetic Equations	WRB-9
MSP-017	Inverse Problems in Tomography	AT-2B
MSP-039	The Motion of Systems Containing Rigid and Elastic Bodies in Resisting Continuum III	AFB-19
MSP-085	Dynamical Systems in Manufacturing III	AT-8
MSP-093	Advanced Methods of Composite Design for Shell Structures	DHT-C
MSP-095	Singularly Perturbed Boundary Value Problems: Theory and Applications	AT-6
MSP-105	Robust Geometric Computation and Applications I	DHT-3.01
MSP-136	Mathematical Facets of Climate Research	DHT-S
MSP-153	Evaluation of Commercial CFD-Software	DHT-B
MSP-171	New Advances in Medical Imaging	WRB-1
MSP-174	Preconditioners for Spectral and hp Methods I	AT-5
MSP-185	Scaling Up and Homogenization for Multiphase Flow in Heterogeneous Porous Media	AT-1
MSP-189	Interface Motion Problems From Materials Science	WRB-11
MSP-191	Cache-Friendly Algorithms in Scientific Computing	MS-3
MSP-200	Low Mach Number Flow	AT-2
MSP-203	Second Order Analysis of Optimal Control Problems I	AFB-10
MSP-215	Nonlinear Waves II	WRB-2
MSP-219	Self-Focusing: Theory and Applications I	WRB-10
MSP-225	Modeling and Computational Challenges in Deregulated Electricity Markets	WRB-8
MSP-229	Validated Error Bounds for the Numerical Solution of ODEs	DHT-4.01
MSP-243	Teaching and Research of Certain Topics in Industrial Mathematics in Afro-Asian Countries	AT-3
MSP-248	Mathematical Modelling of Orbital Debris Production and Evolution	DHT-4.18
MSP-262	Flow in Composite Materials (ECMI Symposium)	MS-1
MSP-267	Integrating Symbolic and Numeric Computations: Algorithms and Software I	MS-4
MSP-269	Turbulence Theory	DHT-N
MSP-271	Mathematical Methods in Molecular Biology	AT-4

Friday, 9 July, Morning Session
Details

09.00 – 09.45 Plenary Lectures

Plenary Lecture — William Robertson Building, Lecture Theatre 8

O A OLEINIK (Moscow MV Lomonosov State University, Russia)

On Homogenization of Differential Operators

Chair: R J KNOPS (Heriot-Watt University, UK)

Plenary Lecture — McEwan Hall

Michele PARRINELLO (Max-Planck Institut für Festkörperforschung, Stuttgart, Germany)

Large Scale Ab-Initio Molecular Dynamics: Algorithms and Industrial Applications

Chair: N G Barton, CMIS, North Ryde, Australia ()

The molecular dynamics simulation of condensed phases is an important branc h of computational chemistry and physics. In molecular dynamics, given a m odel for the potential of interaction betweeen the atoms, ions or molecules , the time evolution of the system is obtained by numerically solving Newto n's equation of motion. This gives access to the microscopic behaviour of the system. Through these simulations experimental research can be guided and complemented, difficult and costly experiments replaced and above all v ery precious insights obtained. A crucial ingredient in these simulations is an appropriate description of the interatomic forces. Very often, howev er, these are imperfectly known, especially in systems where complex chemic al interactions are present. For this reason, the method of *ab-initio* molecular dynamics has been developed over the last fifteen years. In th is approach the interatomic forces are not an input of the calculation, but are determined "on the fly" from accurate electronic calculations. This provides added accuracy and predictive power and opens the way for the simul ation of complex chemical processes. These advantages, however, come at a substantially increased computational cost, since in order to calculate the forces from the electronic structure one needs to solve the Schrödinger equation along the simulation trajectory. We will show that efficient algo rithms can be constructed to this effect. The complexity of these algorith ms will be analysed and present efforts to achieve a linear scaling with sy stem size reviewed. A number of applications ranging from materials scienc e to industrial catalysis and drug design will be briefly discussed.

Plenary Lecture — George Square Lecture Theatre

Y YUAN (Chinese Academy of Sciences, Beijing, China)

A Review of Trust Region Algorithms for Optimization

Chair: M H WRIGHT (Bell Laboratories, New Jersey, USA)

Iterative methods for optimization can be classified into two categories: line search methods and trust region methods. Instead of carrying out line searches along any search direction, trust region methods try to find a new approximate solution within a neighbourhood of the current iterate. Trust region methods are robust, and can also be applied to ill-conditioned problems. Because of the trust region constraint, trust region subproblems may be non-convex, which means that the approximate Hessian can be any symmetric matrix (without assuming positive semidefinite). Therefore we can use a wider class of functions to construct subproblems in trust region methods than in line search methods. Conditions for ensuring the convergence of trust region methods are normally weaker than those for line search methods. Recent advances on trust region algorithms for nonlinear optimization are discussed. Most trust region algorithms use quadratic model, such as Newton's method and quasi-Newton methods. Non-quadratic models, such as conic models are considered. Interior point technique, non-monotone technique, null-space technique, exact penalty function approach and second order correction step technique can also be used in trust region methods. Theoretical properties of various trust region subproblems and their numerical algorithms are discussed. Possible applications of the trust region idea to other optimization problems such as linear programming, semi-definite programming and multi-objective optimization will also be considered.

10.05 – 12.05 Mini-Symposia

MSP-010
Numerical Methods for Kinetic Equations

William Robertson Building, Seminar Room 9

Organiser: JÜNGEL, Ansgar (Fachbereich Mathematik, Technische Universität Berlin, Germany)

Kinetic equations arise in the description of nonlinear transport phenomena of gases, charged particle transport in semiconductors and plasma physics, and they are a challenging field of numerical and applied mathematics. This minisymposium focuses on new developments of numerical methods for kinetic equations. In particular, Boltzmann equations and kinetic models in rarefied gas dynamics are considered. In the talks the latest results on asymptotic-preserving methods, finite-difference discretizations of moment systems and Monte-Carlo methods are presented. Furthermore, numerical results for diffusion-type equations and the semiconductor Boltzmann equation are shown.

KLAR, Axel (FU Berlin, Germany) *Numerical low Mach number limit for kinetic equations* (p. 21)
MAJORANA, Armando (Dipartimento di Matematica, Universita' di Catania, Italy) *Spherical-harmonic type expansion for the Boltzmann equation in semiconductor devices: Numerical results* (p. 21)
MAS-GALLIC, Sylvie (Université Evry-Val-d'Essonne and Ecole Polytechnique CMAP, France) *Diffusion velocity method: Applications to kinetic problems* (p. 21)
RUSSO, Giovanni (Dipartimento di Matematica, Università dell'Aquila, Italy) *Spectral methods for the Boltzmann equation* (p. 21)
SCHMEISER, Christian (TU Wien, Austria) *Semiconductor device simulation by higher order moment systems* (p. 21)

MSP-017
Inverse Problems in Tomography

Appleton Tower, Room 2B

Organisers: HANKE, Martin (Johannes-Gutenberg-Universität Mainz, Germany)
SCHERZER, Otmar (Institut für Industriemathematik, Universität Linz, Austria)

A large number of challenging mathematical problems arising in industrial applications can be formulated as Inverse Problems or Control Problems. In either case the goal is to adjust manufacturing parameters or to determine other, physical, quantities. Those numbers are required to run computer simulations and, eventually, to realize new industrial products. Depending on the application, the precise figures of these parameters may not be of primary importance. However, in applications where a parameter has a strong physical interpretation (like a thermal conductivity coefficient, for example),it is usually important that it be reconstructed qualitatively correct. This minisymposium will concentrate on applications from Industrial Process Tomography where the reconstruction of physical parameters is essential; it will address both, people from industry and researchers in applied mathematics.

NAGY, James (Southern Methodist University, Dallas, USA) *Resolution enhancement of CT images using spatially variant image restoration methods* (p. 30)
CHENEY, Margaret (Rensselaer Polytechnic Institute, USA) *An asymptotic wave interpretation of sonar images* (p. 29)
PIDCOCK, Michael (Oxford Brookes University, UK) *Image reconstruction in electrical impedance tomography* (p. 30)
BRÜHL, Martin (Universität Karlsruhe, Germany) *Reconstruction of inclusions with electrical impedance tomography* (p. 29)
SANTOSA, Fadil (Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, USA) *Quantitative nondestructive evaluation using Eddy current methods* (p. 30)

MSP-039 Adam Ferguson Building, Room 19

The Motion of Systems Containing Rigid and Elastic Bodies in Resisting Continuum III

(see also Part I, MSP-027, p. 120; Part II, MSP-038, p. 141)

Organiser: ILJUKHIN, Alexander A (Pedagogical institute, Taganrog, Russia)

ILJUKHIN, Alexander A (Pedagogical Institute, Taganrog, Russia) *Vibrations of the rigid body on the elastic rod in airflow* (p. 38)
SAMSONOV, Vitalii (Lomonosov Moscow State University, Institute of Mechanics, Russia) *Computer modeling of continuum influence upon a rigid body* (p. 39)
KONOSEVICH, Boris I (Donetsk Institute of Applied Math and Mechanics, Ukraine) *Construction of the averaged equations for translational movement of the axially symmetric projectile* (p. 39)
SUDAKOV, Sergey Nikitovich (Institute for Applied Mathematics and Mechanics, Donetsk, Ukraine) *Autorotation of a specific form plate, free-falling in the air* (p. 39)

MSP-085 Appleton Tower, Seminar Room 8

Dynamical Systems in Manufacturing III

(see also Part I, MSP-083, p. 122; Part II, MSP-084, p. 142; Part IV, MSP-266, p. 171)

Organisers: BLACKMORE, Denis (New Jersey Institute of Technology, USA)
SAMOILENKO, Anatoliy M (Institute of Mathematics, National Academy of Sciences, Ukraine)
PRYKARPATSKY, Anatoliy K (AGH, Poland and Dept. of Nonlin. Mathem. Analysis, IAPMM of the NAS, Lviv, Ukraine)

BLACKMORE, Denis (New Jersey Institute of Technology, USA) *Quasi-ergodic flows in automated assembly* (p. 83)
KULYK, K (Glivice Polytechnical Institute, Poland) *Greens function structure for dynamical systems*
NAPORA, Jolanta (Dept. of Applied Mathematics, AGH, Krakow, Poland) *The moser type representation of integrable Riccati-Abel ordinary differential equations and its Lie-algebraic structure* (p. 84)

MSP-093 David Hume Tower, Lecture Theatre C

Advanced Methods of Composite Design for Shell Structures

Organiser: BODE, Joerg (BMW Rolls-Royce Aero Engines GmbH, Dahlewitz, Germany)

The minisymposium will provide advanced methods of composite design for different shell applications out of the satellite or turbine engine design. Focal point in here is a target function, i.e. "shape constant" for satellite antennas or "weight optimized" and endurance safe for shells in turbo engines. With special numerical optimization tools out of a finite element analysis, the metric of the shell is used to define the composite layup also thermally. This is a very helpful design aid in practice, since the main curvature parameters of the shell are leading automatically to an advanced structure. These structures are either weight optimized or safe for unlimited life or fulfill any other criterion, which can be defined in advance. In addition to that, it will be shown, that the selected shell structures are flaw and imperfection tolerant using modern composite failure criteria. The mini symposium is a presentation of results of successful co-work between industry and universities. In both cases composite FE-analysis methods and failure mode tools were improved for further use in practice.

BODE, Joerg (BMW Rolls-Royce Aero Engines GmbH, Germany) *Design of a thermo-stable satellite antenna* (p. 94)
LENK, Olaf (Technical University of Berlin, Berlin, Germany) *Weight optimized layout of a high pressure compressor core fairing of a turbo engine* (p. 94)
SCHURIG, Michael (BMW Rolls-Royce Aero Engines GmbH, Germany) *Flaw tolerant design of load carrying composite shell structures* (p. 94)
MIDDENDORF, Peter (University of the Federal Armed Forces, Munich, Germany) *Structural layout of the Lunarstar subsatellite Gauss using a CFRP-sandwich design* (p. 94)

MSP-095 Appleton Tower, Seminar Room 6

Singularly Perturbed Boundary Value Problems: Theory and Applications

Organisers: VASILIEVA, Adelaida B (Moscow University, Moscow, Russia)
STRYGIN, Vadim V (Voronezh State University, Voronezh, Russia)

In many applications such as problems of chemical kinetics, biochemistry, control one needs to use singularly perturbed equations. Asymptotic methods play an important role in investigation of singularly perturbed problems. Meanwhile, there is a number of problems in chemical reaction theory, control theory e.c. where asymptotic methods are not developed. We intend to present some new classes of singularly perturbed systems of ordinary differential equations and partial differential equations, too. A number of applications in the fields of chemical reactors, vibration control and semiconductor lasers will be considered. The mini-symposium will include the discussion on analytical expansions, proofs, numerical experiments.

BLATOV, Igor A (Voronezh State University, Russia) *The Galerkin finite element method for singularly perturbed elliptic and parabolic equations* (p. 95)
SHARUDA, Dmitry V (Voronezh State University, Russia) *Asymptotical expansion of Cauchy problems for singularly perturbed delay systems* (p. 96)
VASILIEVA, Adelaida B (Department of Mathematics, Faculty of Physics, Moscow State University, Russia) *Contrast structures of alternating type* (p. 96)
NEFEDOV, Nikolai (Department of Mathematics, Faculty of Physics, Lomonosov Moscow State University, Russia) *Singularly perturbed systems in the case of exchange of stability* (p. 95)
NIKITIN, Andrey G (Department of Mathematics, Faculty of Physics, Moscow State University, Russia) *The solutions with internal and boundary layers of singularly perturbed boundary value problem for integro-differential equations* (p. 95)
STRYGIN, Vadim V (Voronezh State University, Russia) *Vibrational control of singularly perturbed delay systems* (p. 96)

MSP-105 David Hume Tower, Room 3.01

Robust Geometric Computation and Applications I

(see also Part II, MSP-106, p. 166)

Organiser: SUGIHARA, Kokichi (University of Tokyo, Japan)

Numerically robust implementation of geometric algorithms seems the most crucial bottleneck for industrial applications of computational geometry. This mini-symposium focuses our attention on the robustness issue, and offers an opportunity to exchange ideas for overcoming this bottleneck. The talks include a variety of geometric problems such as triangulation, digital line extraction and finite element methods, but all the approaches have generality in the sense that they can be applied to a wide range of geometric problems. All the speakers have plenty of experiences in constructing geometric software based on their own approaches.

OHSAWA, Akira (Chubu University, Japan) *2D space model for general robust geometric algorithms* (p. 105)
FORTUNE, Steven J (Bell Labs, Lucent Technologies) *The reliable implementation of geometric algorithms using exact arithmetic* (p. 104)
ASANO, Tetsuo (JAIST, Japan) *An efficent and robust algorithm for enumerating digital line components* (p. 104)
IMAI, Toshiyuki (Wakayama University, Japan) *Symbolic perturbation based on Gröbner basis* (p. 104)

MSP-136 David Hume Tower, Faculty Room South

Mathematical Facets of Climate Research

Organiser: TAMPIERI, Francesco (CNR, Italy)

Understanding and forecasting climate changes is a challenge for the sciences of the environment. Observations and models refer to many different disciplines, like physics, chemistry, biology, geology; mathematics is a common backbone for dealing with all the various issues using a unifying language. Data analysis and interpretation, fundamental predictability and numerical simulations of atmosphere and ocean are various aspects of the climate research. The minisymposium is devoted to discuss these topics, stressing the mathematical methods used and the perspectives for the future.

MSP-153
Evaluation of Commercial CFD-Software

David Hume Tower, Lecture Theatre B

Organisers: OERTEL, Herbert (Institute for Fluid Mechanics, University of Karlsruhe, Germany)
OHLE, Frank (Endress+Hauser, Flowtec AG Switzerland)

The Mini-Symposium deals with the evaluation of commercial CFD-Software, applied in the practical industrial process of product development and research. The speakers, which are active in the industrial field, at research laboratories and in the university, give insights into the following topics of CFD-applications: - mathematical accuracy of temporal and spatial discretisation methods in the numerical schemes - error estimation methods - grid generation for complex geometries - verification process with quantitative experiments - validation of the physical and chemical models. The practical aspects of Fluid-Mechanic computations of internal combustion flows, direct injection multiple phase flows will be illuminated, as well as the thermo-physical aspects of the passenger compartment flow in auto-motives, two-phase flows in the cooling process of nuclear reactors and hydraulic valve flows in automotive safety systems. Finally, the limits of turbulence and reacting flow modeling will be discussed.

MSP-171
New Advances in Medical Imaging

William Robertson Building, Seminar Room 1

Organiser: FISCHER, Bernd (Insitute of Mathematics, Medical University of Lübeck, Germany)

Image and signal processing have many potential applications in the medical sciences. The problems are often computationally intensive and accurate and efficient methods are needed. In recent years two major approaches have become popular: nonlinear PDE and wavelet based methods. The speakers in this minisymposium will present progress made in these respective directions. Applications to medical imaging problems including image enhancement, registration of multiple images and feature extraction are discussed.

MSP-174 Appleton Tower, Lecture Theatre 5

Preconditioners for Spectral and hp Methods I

(see also Part II, MSP-175, p. 167)

Organisers: PAVARINO, Luca F (University of Milano, Department of Mathematics, Italy)
GUO, Benqi (University of Manitoba, Canada)

The discretization of partial differential equations by spectral and hp finite element methods produces large systems of algebraic equations which are more ill conditioned than those of lower order discretizations. The iterative solution of such systems requires efficient and parallel preconditioners in order to attack complex 3D problems in fluid-dynamics and structural mechanics. This minisymposium presents some of the current directions of research based on domain decomposition and multigrid techniques, which in recent years have provided some of the best preconditioners for low order methods.

MSP-185 Appleton Tower, Lecture Theatre 1

Scaling Up and Homogenization for Multiphase Flow in Heterogeneous Porous Media

Organiser: ABABOU, Rachid (Institut de Mecanique des Fluides de Toulouse (IMFT), France)

This symposium presents homogenization and scaling up methods aimed at characterizing the macroscale behavior of single and multiphase flows in heterogeneous and "nonlinear" porous media. The porous medium is assumed to have spatially variable local properties, e.g. permeability versus capillary pressure curve. The heterogeneity may be a periodic pattern, or a statistical continuum. Transient and nonlinear terms interact with heterogeneity in a complex way, leading to scaled up equations with nonlocal or non-stationary fluctuations in space, nonlocal behavior in time, etc. In fact, in the case of single phase Darcy flow, which is locally linear, the problem to be solved in terms of averages and fluctuations is generally nonlinear, and (as a consequence) exact closed forms solutions are not known. This symposium is intended to bring together and compare several mathematical methods for scaling up 1- and 2-phase flow equations in terms of macroscale pressures, fluxes, or saturations, based on large-scale averaging, multiple-scale asymptotics, and other expansion methods backed up by numerical experiments.

MSP-189 William Robertson Building, Seminar Room 11

Interface Motion Problems From Materials Science

Organiser: TAYLOR, Jean E (Rutgers University, USA)

Interfaces move in materials when crystals grow or shrink, materials change phase, and polycrystalline materials undergo grain growth and shape change in annealing. Problems include determining appropriate motion laws, proving existence, possible uniqueness or non-uniqueness, and general properties of solutions satisfying these laws, and developing accurate and efficient means of computing them. Areas of investigation include treatment of non-differentiable surface free energy functions, formation and motion of multi-junction curves and points, combinations of effects of surface diffusion and attachment-detachment kinetics, bulk diffusion, and elastic deformation.

MSP-191 Management School, Lecture Theatre 3
Cache-Friendly Algorithms in Scientific Computing

Organiser: POTHEN, Alex (Old Dominion University and ICASE, NASA Langley Research Center, USA)

Modern computer architectures improve performance by executing a number of instructions in parallel: they achieve this by pipelining instructions, replicating functional units, issuing multiple instructions per clock cycle, executing instructions out-of-order, and predicting the direction of branches. However, since execution times of instructions improve at a faster rate than memory access times, feeding the CPU with data operands is the bottleneck in many irregular computations. This bottleneck is alleviated by means of caches, small fast memories to which data can be moved from the larger and slower primary memory, and from which data can be moved to the CPU. The performance of an irregular computation (e.g., unstructured meshes and sparse matrix algorithms) depends critically on whether most of the data accesses can be performed within the cache. Thus cache-residence of the memory accesses has become a measure of the running time complexity of an algorithm, together with conventional measures such as the total number of operations. The speakers in this minisymposium will discuss the issues involved in reordering data accesses within an algorithm and in developing algorithmic variants for scientific computing that enable high cache performance.

MSP-200 Appleton Tower, Lecture Theatre 2
Low Mach Number Flow

Organisers: KRÖNER, Dietmar (Institut für Angewandte Mathematik, Freiburg, Germany)
MUNZ, C-D (Institut für Aero- und Gasdynamik, Stuttgart, Germany)

The efficiency of standard numerical methods for compressible fluid flow strongly decreases when the Mach number of the flow becomes small. This implies that the sound velocity becomes infinite and therefore the limit will be singular. There are several basic approaches: Special precondition techniques and asymptotic expansions based on multiple scales for the pressure have been used. Another possibility is to apply the SIMPLE idea to the compressible equations in primitive variables which gives an additional pressure correction equation. The aim of this minisymposium is to give a review about the progress in this area. We want to propose a bench-mark problem for comparing different methods.

MSP-203 Adam Ferguson Building, Room 10

Second Order Analysis of Optimal Control Problems I

(see also Part II, MSP-204, p. 169)

Organiser: BONNANS, J Frédéric (INRIA-Rocquencourt, France)

This session will illustrate how some general tools of abstract optimization theory allow to derive powerful results concerning the second order analysis of optimal control problems, both for ordinary and partial differential equations.

MALANOWSKI, Kazimierz (Systems Research Insitute, Newelska 6, Warsaw, Poland) *Characterization of Lipschitz stability of solutions to parametric optimal control problems* (p. 186)
GUILBAUD, Thérèse (INRIA, Domaine de Voluceau, Rocquencourt, France) *Logarithmic penalty and shooting methods* (p. 186)
ZIDANI, Housnaa (INRIA Rocquencourt, France) *Second order analysis of optimal control problems with partially polyhedric constraints* (p. 186)

MSP-215 William Robertson Building, Seminar Room 2

Nonlinear Waves II

(see also Part I, MSP-214, p. 146; Part III, MSP-216, p. 169)

Organisers: CHEN, Min (Penn State University and University of Texas at Austin, USA)
BONA, Jerry (Univercity of Texas, Austin, USA)

BONA, Jerry (University of Texas at Austin, Texas, USA) *Initial-boundary-value problems for nonlinear wave equations* (p. 192)
SUN, Shu Ming (Virginia Polytechnic Institute and State University, Blacksburg, USA) *Periodic waves of finite amplitude in a two-fluid flow* (p. 193)
CHAMPNEYS, Alan R (University of Bristol, UK) *Solitary waves and fourth-order equations; An overview* (p. 192)
DOUGALIS, Vassilios A (Mathematics Department, University of Athens and Institute of Applied & Computational Mathematics, FORTH, Greece) *Numerical solution of Boussinesq systems* (p. 192)

MSP-219 William Robertson Building, Seminar Room 10

Self-Focusing: Theory and Applications I

(see also Part II, MSP-220, p. 169)

Organiser: FIBICH, Gadi (Tel-Aviv University, Israel)

The general theme of this mini-symposium is self-focusing in the nonlinear Schrödinger equation. Talks will include theoretical studies, new numerical techniques, asymptotical analysis and applications to various physical models.

ILAN, Boaz (School of Mathematics, Tel-Aviv University, Tel-Aviv, Israel) *Vectorial effects in self-focusing* (p. 195)
SULEM, Pierre-Louis (CNRS, Observatoire de la Côte d'Azur, France) *Collapse of nonlinear Alfvén wave* (p. 196)
FIBICH, Gadi (Tel-Aviv University, Israel) *Damping effects in critical self-focusing* (p. 195)

MSP-225 William Robertson Building, Lecture Theatre 8

Modeling and Computational Challenges in Deregulated Electricity Markets

Organisers: DAVIS, Paul W (Worcester Polytechnic Institute, USA)
CLEMENTS, Kevin A (Worcester Polytechnic Institute, USA)

A wave of electric utility deregulation is sweeping the globe. With it comes a new set of modeling and computational challenges that arise from the need for new types of economic information, demands for more stringent monitoring to accommodate tighter operating margins, and opportunities to find profits in changed operating environments. The speakers will describe some of these challenges and current approaches to meeting them.

CLEMENTS, Kevin A (Worcester Polytechnic Institute, USA) *A state estimation framework for detecting rogue power transactions* (p. 199)
ILIC, Marija D (Massachusetts Institute of Technology, USA) *Measures for comparing performance of regulated and deregulated electric power industries* (p. 199)
ALVARADO, Fernando (University of Wisconsin-Madison, USA) *Estimating power market conditions from network observations* (p. 199)

MSP-229 David Hume Tower, Room 4.01
Validated Error Bounds for the Numerical Solution of ODEs

Organisers: NEHER, Markus (University of Karlsruhe, Germany)
RIHM, Robert (University of Karlsruhe, Germany)

The approximate numerical solution of ODEs is usually subject to discretization errors and to the floating point roundoff errors in computation. In contrast, interval computations based algorithms for ODEs yield verified bounds of the solution by estimating these errors with computable data. Starting with Moore's pioneering work in the early 60s, a growing interest in this field has only recently led to a large variety of new enclosure algorithms. The mini-symposium wishes to provide an overview of the state of the art of current research on this topic.

LOHNER, Rudolf (University of Karlsruhe, Germany) *Enclosure of solutions of ODEs: past, present, and future* (p. 202)
NEDIALKOV, Ned S (Department of Computer Science, University of Toronto, Toronto, Canada) *On stepsize control and stability in validated methods for IVPs for ODEs* (p. 202)
RIHM, Robert (University of Karlsruhe, Germany) *Validated predictor-corrector methods* (p. 203)
NEHER, Markus (Karlsruhe University, Germany) *On the use of geometric series to bound the local error of Taylor methods* (p. 202)
HARTMANN, Michael (Technical University of Braunschweig, Germany) *Runge-Kutta methods for the validated solution of ODEs* (p. 202)

MSP-243 Appleton Tower, Lecture Theatre 3
Teaching and Research of Certain Topics in Industrial Mathematics in Afro-Asian Countries

Organiser: SIDDIQI, Abul H (King Fahd University of Petroleum and Minerals and Aligarh Muslim University, India)

The speakers will focus their experience in promoting teaching and research of certain topics in Industrial Mathematics in countries like India, Nepal, BanglaDesh, Saudi Arabia, Iran, Kuwait, Turkey and Algeria. These topics include free boundary problems, inverse problems, image processing and modelling of financial derivatives, environmental, oil and climate problems. They will also briefly mention the research work of their groups and will indicate the ways and means for active collaboration between the researchers of these countries and the developed countries.

KAPUR, Jagat N (Jawaharlal Nehru University, New Delhi, India) *A review of the teaching and research in developing countries* (p. 211)
MANCHANDA, Pammy (Gurunanak Deo University, Amritsar, India) *Current researches on financial derivatives in Afro-Asian countries* (p. 211)
ASLAN, Zafer (Beykent University, Turkey) *Modeling of environmental and climatic problems: prediction of wind and water erosion* (p. 211)
SIDDIQI, Abul H (Department of Mathematical Sciences, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia) *Varitional methods and image processing in the third world countries* (p. 211)

MSP-248 David Hume Tower, Room 4.18

Mathematical Modelling of Orbital Debris Production and Evolution

Organisers: SMIRNOV, Nickolay N (Moscow MV Lomonosov State University, Russia)
KISELEV, Alexey B (Moscow MV Lomonosov State University, Russia)

Since the time the first Sputnik was launched on October 4, 1957 and the Space Era began mankind was enthusiastic in bringing satellites into orbits, using the wonderful opportunities given by the space achievements for telecommunications, navigation, Earth observations, weather forecasts, etc., etc., and nobody gave thought to a possible negative impact on the Space Environment. Now it is high time to step aside and look around. Space activity of the mankind generated a great amount of orbital debris, i.e. manmade objects and their fragments launched into Space, inactive at nowadays and not serving any useful purpose. Those objects sizing from hundreds of microns up to decimeters, traveling at orbital velocities, remaining in orbits for many years and numbering billions formed a new media named "space debris" and became a serious hazard to space flights. Collision with a debris metallic particle of 1 cm radius is energetically equivalent to a collision with half a ton mass car moving at a speed 100 km per hour. The contributors to the Minisymposium will be the well-known specialists in the field of orbital debris studies from Europe, Japan, Russia and USA. The presentations will face the problems of mathematical modelling of the "space debris medium" evolution, orbital breakups and collisions modelling as major sources of production of debris particles, collision hazards assessment and mitigation. A new concept of Space Ecology will be introduced that would be probably very interesting to a wide spectrum of participants.

SMIRNOV, Nickolay N (Moscow MV Lomonosov State University, Russia) *Mathematical model for space debris evolution, production and self-production* (p. 214)
KISELEV, Alexey B (Faculty of Mechanics and Mathematics, Moscow MV Lomonosov State University, Russia) *Hypervelocity collisions and orbital breakups mathematical modeling* (p. 214)
POTTER, Andrew E (Lunar Planetary Institute, Houston, USA) *Orbital breaking events observations* (p. 214)
NAZARENKO, Andrey I (Center for Program Studies of the Russian Space Agency, Russia) *The solution of applied problems using space debris analysis models* (p. 214)

MSP-262 Management School, Lecture Theatre 1

Flow in Composite Materials (ECMI Symposium)

Organiser: MCKEE, Sean (University of Strathclyde, Glasgow, UK)

Advanced fibre-reinforced composite materials have found important applications in the aerospace and automative industries. Composite materials are desirable because they are light-weight, have high strength and offer design flexibility. There are many different, but related methods such as prepreg and resin film infusion or methods more capable of automation such as resin transfer moulding (RTM). The are all related by the fact that they all involve heat transfer, flow through porous media and polymerisation. This minisymposium will address the mathematical modelling of the flow processes in composite manufacture with a view to enhanced product quality.

PREZIOSI, L (Politecnico di Torino, Italy) *The theory of deformable porous media and its application to composite material manufacturing*
ZULKIFLE, A K (University of Strathclyde, Glasgow, UK) *Curing Simulation by Autoclave Resin Infusion* (p. 223)
AMBROSI, D (Centro Ricerche e Sviluppo Studi, Cagliari, Italy) *Modelling injection moulding processes with deformable porous preforms*
SVANSTEDT, Nils (Chalmers University, Sweden) *Two-scale limits and mean fields for flows* (p. 222)

MSP-267 Management School, Lecture Theatre 4

Integrating Symbolic and Numeric Computations: Algorithms and Software I

(see also Part II, MSP-268, p. 172)

Organisers: MORENO MAZA, Marc (The Numerical Algorithms Group Ltd, UK)
GONZALEZ-VEGA, Laureano (Universidad de Cantabria, Spain)

The need to "solve" (i.e. simplify or find solutions to) systems of polynomials arises in many areas of science and engineering: for example geometric modelling, robotics, chemical engineering, scheduling, computational biology and electronics. The aim of the european project FRISCO (A Framework for Integrated Symbolic/Numeric Computations) was to investigate and develop technologies which can be used to deliver highly efficient, versatile polynomial solvers to industrial users. The results of the project includes a framework for building integrated symbolic/numeric applications, and a number of demonstration applications. The suitability of this software for these purposes will be demonstrated during this mini-symposium.

FIORENTINO, Giuseppe (Dipartimento di Matematica - Università di Pisa - Italy) *Numerical solving of polynomial systems* (p. 225)
WATT, Stephen (Projet Saphir, INRIA, France) *Software for integrating symbolic and numeric computations*
FAUGÈRE, Jean-Charles (LIP6/CNRS, Université Paris VI, France) *Algebraic solving of polynomial systems*
GONZALEZ-VEGA, Laureano (Universidad de Cantabria, Spain) *Integrating symbolic and numeric computations in CAGD* (p. 225)
MOURRAIN, Bernard (INRIA, SAGA, FRANCE) *Integrating symbolic and numeric Computations. Applications to robotics and computational biology* (p. 225)

MSP-269 David Hume Tower, Faculty Room North

Turbulence Theory

Organisers: MCCOMB, W D (University of Edinburgh, Scotland, UK)
HUNT, J C R (University of Cambridge, UK)

Over the past twenty years developments in the speed and power of computers have led to a rapid growth in the application of numerical methods to problems in fluid mechanics. However, in both industrial and environmental situations, the bedrock difficulty remains the lack of a satisfactory theory or model of turbulence upon which to base predictions. The need for a better understanding of basic aspects of turbulence has been recognized by the setting up of a research programme on turbulence at the Isaac Newton Institute for Mathematical Sciences at Cambridge for the period January to June 1999. The aim of the present session is to stimulate discussion of some basic issues in turbulence theory, taking into account any developments from the research programme at INI. The presentations will cover current aspects of turbulence theory, such as universality, scaling and the use of renormalization methods.

CHORIN, Alexandre J (University of California, Berkeley, USA) *New perspectives on scaling laws*
HUNT, J C R (University of Cambridge, UK) *The non-universality of turbulence*
KIDA, S (National Institute for Fusion Science, Nagoya, Japan) *DIA theory: Principle and applications* (p. 226)
MCCOMB, W D (University of Edinburgh, Scotland, UK) *Renormalization group with asymptotic freedom*

MSP-271 Appleton Tower, Lecture Theatre 4

Mathematical Methods in Molecular Biology

Organiser: ISTRAIL, Sorin (Sandia National Laboratories, USA)

This mini-symposium focuses on computational biology. The research presented will deal with discrete mathematics problems inspired by the Human Genome Project. They will include: genomic mapping, gene identification, biomolecular sequence analysis, and protein structure prediction.

GIANCARLO, Raffaele (University of Palermo, Italy) *Hidden Markov models in molecular biology* (p. 227)
APOSTOLICO, Alberto (Purdue University, USA and University of Padova, Italy) *Algorithms for detecting unusual words* (p. 227)
ISTRAIL, Sorin (Sandia National Laboratories, USA) *Combinatorial algorithms for structure prediction*
RAVI, R (Carnegie Mellon University, USA) *A set covering formulation of the epitope selection problem* (p. 227)

ICIAM 99
5 - 9 July 1999

Friday, 9 July, Afternoon Session
Overview

13.00 – 15.00 Mini-Symposia		
MSP-058	Mathematically Modelling Motion and Fragmentation of Large-Scale Bodies in the Atmosphere	DHT-S
MSP-075	Evolving Interfaces and Diffusion Equations	WRB-8
MSP-102	Bifurcation Methods for Vlasov - Maxwell Equations and Theory of Nonlinear Waves	WRB-9
MSP-106	Robust Geometric Computation and Applications II	DHT-3.01
MSP-135	Inverse Problems in Medical Imaging	WRB-1
MSP-158	New Problems of Contrast Structures Theory	WRB-4
MSP-175	Preconditioners for Spectral and hp Methods II	AT-5
MSP-178	Time Stepping for Viscous Incompressible Flow: State of the Art and New Ideas	DHT-B
MSP-186	Numerical Modelling of Flow and Transport in Fractured Porous Media	AT-1
MSP-188	Nonconforming Domain Decomposition Approximations for the Maxwell Equations	AT-6
MSP-201	Absorbing Boundary Conditions	AFB-19
MSP-204	Second Order Analysis of Optimal Control Problems II	AFB-10
MSP-216	Nonlinear Waves III	WRB-2
MSP-220	Self-Focusing: Theory and Applications II	WRB-10
MSP-233	Computational Methods for Microstructures and Modelling of Materials	WRB-11
MSP-245	Pulsed Beams and Physical Wavelets in Acoustics and Electromagnetics	DHT-N
MSP-251	Plate and Shells: Asymptotic Methods	DHT-C
MSP-254	Aeroacoustics	AT-2
MSP-263	Centre for Applied and Industrial Mathematics in Scotland (AIMS)	MS-1
MSP-266	Dynamical Systems in Manufacturing IV	AT-8
MSP-268	Integrating Symbolic and Numeric Computations: Algorithms and Software II	MS-4
15.20 – 16.20 Congress Review and Closing Ceremony		

Also this evening		
17.00 - 19.00	**Maxwellian Themes Symposium**, see p. 222	Royal Society of Edinburgh

Friday, 9 July, Afternoon Session
Details

13.00 – 15.00 Mini-Symposia

MSP-058 David Hume Tower, Faculty Room South

Mathematically Modelling Motion and Fragmentation of Large-Scale Bodies in the Atmosphere

Organisers: GRIGORIAN, Samvel S (Institute of Mechanics, Moscow Lomonosov State University, Russia)
STULOV, Vladimir P (Institute of Mechanics, Moscow Lomonosov State University, Russia)

A goal of the Minisymposium is a discussion of modern theories of meteor body motion in the atmosphere of planets. The theory is based on the results of high-speed aerodynamics. The difference between space vehicle aerodynamics and bolide physics is, first of all, in absence of knowledge about shapes of meteoroids and of their physical-mechanical properties. On the other hand, the main aerodynamical laws are the same for vehicles and meteoroids. This permits one to achieve some new developments in meteor physics. Besides that some results of the latter could be used for study of high-speed flight of space vehicles: non-equilibrium flow field around a body, radiation of the perturbed air in some frequency ranges, physico-chemical rates in a wake behind a body, etc.

MSP-075 William Robertson Building, Lecture Theatre 8

Evolving Interfaces and Diffusion Equations

Organisers: HILHORST, Danielle (Analyse Numérique et EDP, Université de Paris-Sud, France)
RODRIGUES, José-Francisco (CMAF/Universidade de Lisboa, Portugal)

The goal of this minisymposium is to present and discuss recent results on moving interfaces and nonlinear parabolic systems. Among the recent progresses in the mathematical research of free boundary type problems for partial differential equations, because of their current developments, those of diffusion type are of particular interest. This set of contributions, including the mathematical treatment of several models such as Stefan type problems, modified motion by mean curvature as well as triple junctions and facetted interfaces, will be of interest to applied analysts and other scientists working in this wide class of problems.

MSP-102 William Robertson Building, Seminar Room 9
Bifurcation Methods for Vlasov - Maxwell Equations and Theory of Nonlinear Waves

Organisers: SIDOROV, Nikolay A (Irkutsk State University, Russia)
TRENOGIN, Vladilen A (Moscow Steel & Alloys Institute, Russia)

Theme of discussion: 1) study of bifurcation appearances for Vlasov - Maxwell systems and bifurcation problem for capillary - gravitational, periodic and solitary waves; 2) statements and research of the appropriate nonlinear boundary value problems with the known or free boundary. Bifurcation phenomenon play an important role in these problems. They are connected with changes in the qualitative behavior of nonlinear systems, and to appear a new solutions (branching, bifurcation, catastrophe). It is offered to discuss development and application to the specified nonlinear problems of the following methods and approaches: a) local and global prolongation on a parameter; b) group analysis of the differential equations with applications to the numerical analysis in the theory of a branching ; c) combination of these methods and appropriate aspects of analytical, variational and topological methods of a nonlinear functional analysis.

TRENOGIN, Vladilen A (Department of Mathematics, Moscow State Steel and Alloys Institute, Russia) *Bifurcation equation for one-parametric families of solutions of nonlinear equations* (p. 102)
LOGINOV, Boris V (Ulyanovsk State University, Russia) *Determination of bending eigenforms and asymptotics of bifurcating solutions at the divergence of rectangular plate* (p. 102)
SIDOROV, Nikolay A (Irkutsk State University, Russia) *On asymptotic bifurcation directions for Vlasov-Maxwell system in the plasma theory* (p. 102)

MSP-106 David Hume Tower, Room 3.01
Robust Geometric Computation and Applications II
(see also Part I, MSP-105, p. 156)

Organiser: SUGIHARA, Kokichi (University of Tokyo, Japan)

IMAI, Hiroshi (Department of Information Science, University of Tokyo, Japan) *Degeneracy issues in integer programming approach to optimum triangulations of points in two and three-dimensional space* (p. 104)
NAEHER, Stefan (Martin-Luther Universitaet Halle, Germany) *Computational geometry with LEDA and CGAL* (p. 104)
SUGIHARA, Kokichi (University of Tokyo, Japan) *Scientific computation using topology-oriented geometric data* (p. 105)

MSP-135 William Robertson Building, Seminar Room 1
Inverse Problems in Medical Imaging

Organisers: ISAACSON, David (RPI, USA)
CHENEY, Margaret (RPI, USA)

Mathematical inverse problems that arise in the diagnosis and treatment of heart disease, brain disfunction, and breast cancer will be presented. Recent progress on imaging electrical and acoustic properties inside a body from measurements made outside the body will be discussed. In order to improve electrocardigraphy, electroencelaography, and ultrasonic imaging, inverse boundary and scattering problems for Maxwell's equations and the acoustic equations arise naturally. These related problems as well as their medical applications will be the focus of this session.

SOMERSALO, Erkki J (Helsinki Finland) *Has agreed to speak but no title yet*
WÜBBELING, Frank (Institut für Numerische und Instrumentelle Mathematik, University of Münster, Germany) *title tbc*
MUELLER, Jennifer L (Rensselaer Polytechnic Institute, USA) *A reconstruction algorithm for EIT data collected on rectangular electrode arrays* (p. 129)
BAO, Gang (UFS, USA) *title tbc*

MSP-158 William Robertson Building, Seminar Room 4
New Problems of Contrast Structures Theory

Organisers: NEFEDOV, Nikolai (Lomonosov Moscow State University, Moscow, Russia)
VASILIEVA, Adelaida B (Moscow University, Moscow, Russia)

Mathematical problems concerning reaction–diffusion problems are of increasing interest because of many applications in chemical kinetics, synergetics, astrophysics, biology, et. al. The solutions of these problems often feature a narrow boundary layer region of rapid change as well as internal layers of different types - so-called contrast structures. We are going to present some new problems and new approaches in the asymptotic theory of contrast structures including contrast structures in the case of exchange of stability, contrast structures in non-local equations. Geometric singular perturbation asymptotic analysis for the exchange of stability problems, asymptotic method of differential inequalities among others will be presented.

VASILIEVA, Adelaida B (Faculty of Physics, Department of Mathematics, Moscow State University, Russia) *Contrast structures arising by change of stability* (p. 148)
SZMOLYAN, Peter (Institut für Angewandte und Numerische Mathematik, TU-Wien, Austria) *Geometric singular perturbation analysis of problems with exchange of stability* (p. 148)
DMITRIEV, Michael G (Russian Peoples Freindship University, Russia) *Contrast structures in singularly perturbed optimal control problems* (p. 147)
NEFEDOV, Nikolai (Moscow University, Moscow, Russia) *Asymptotic method of differential inequalities for problems with contrast structures* (p. 148)
BOHE, Adriana B (Weierstrass Institute For Applied Analysis and Stochastics, Germany) *Supersensitive internal layers in boundary and initial value problems* (p. 147)
KALACHEV, Leonid V (University of Montana, USA) *Asymptotics of a Spike-Type solution* (p. 147)

MSP-175 Appleton Tower, Lecture Theatre 5
Preconditioners for Spectral and hp Methods II
(see also Part I, MSP-174, p. 158)

Organisers: PAVARINO, Luca F (University of Milano, Department of Mathematics, Italy)
GUO, Benqi (University of Manitoba, Canada)

KATZ, I Norman (Washington University, St Louis, Missouri, USA) *Multi-p processes and pre-conditioners* (p. 162)
PATRA, Abani K (State University of New York, USA) *On the development of domain decomposition solvers for adaptive hp finite element methods* (p. 163)
AINSWORTH, Mark (Strathclyde University, Glasgow, UK) *Domain decomposition for hp-finite element approximations in two and three dimensions* (p. 161)
HEUER, Norbert (Universität Bremen, Germany) *Preconditioners for high order boundary element systems* (p. 162)
WARBURTON, Timothy (Oxford University, UK) *Overlapping Schwarz preconditioners for solving elliptic problems on polymorphic/hp elements* (p. 163)

MSP-178 David Hume Tower, Lecture Theatre B
Time Stepping for Viscous Incompressible Flow: State of the Art and New Ideas

Organiser: WETTON, Brian R (Mathematics, UBC, Canada)

In recent years, an analytic understanding of the nature of errors from popular splitting (or projection) methods for viscous incompressible flow has been gained. At the same time, efficient, adaptive codes with solid mathematical foundations have been developed by several groups. In this minsymposium, these developments will be discussed. Some new ideas, such as the use of Guage variables, which could lead to more accurate solutions or more efficient computation, will be brought forward.

WETTON, Brian R (Mathematics, UBC, Canada) *Error analysis of methods for incompressible flow* (p. 166)
BELL, John B (Lawrence Berkeley National Laboratory, Berkeley, USA) *Block-structured adaptive mesh refinement for incompressible flow* (p. 165)
LIU, Jian-Guo (Mathematics, University of Maryland, USA) *Gauge method for viscous incompressible flows* (p. 165)
TUREK, Stefan (Institute for Applied Mathematics, University of Heidelberg, Germany) *Multilevel pressure Schur complement techniques for the incompressible Navier-Stokes equations* (p. 166)
MINION, Michael (Applied Mathematics, University of North Carolina, USA) *Consistent no-slip boundary conditions for pressure increment projection methods* (p. 165)

MSP-186 Appleton Tower, Lecture Theatre 1

Numerical Modelling of Flow and Transport in Fractured Porous Media

Organiser: ROBERTS, Jean E (INRIA, France)

The treatment of fractures in the numerical simulation of flow in porous media is an important and difficult problem with applications in petroleum reservoir, contaminant transport, groundwater and underground waste storage modelling. Depending on the characteristics of the porous medium, the size and type of the fractures and the scale of the problem, very different approaches may be chosen. This minisymposium includes talks concerning several of these approaches: double porosity, stochastic fracture network and discrete fracture models.

PANFILOV, Mikhail (Russian Academy of Sciences, Oil & Gas Research Institute; Russia) *Effective flow in highly heterogeneous disordered media: Homogenization and numerical analysis* (p. 171)
BRUEL, Dominique (Centre D'informatique Géologique - Ecole des Mines de Paris - Fontainebleau - France) *Use of stochastic fracture network models for the flow proble* (p. 170)
JAFFRÉ, Jérôme (INRIA-Rocquencourt, France) *Domain decomposition for flow in a fractured porous medium* (p. 170)

MSP-188 Appleton Tower, Seminar Room 6

Nonconforming Domain Decomposition Approximations for the Maxwell Equations

Organiser: MADAY, Yvon (Laboratoire ASCI, CNRS, France)

The numerical simulation of electromagnetism phenomenon involves generally large scale computations. One reason is that the mesh size should be homogeneous and isotropic all over the domain. Nevertheless in many cases, domain decomposition may be a good way to simplify the discretization by using simple meshes over simple shaped subdomains. The possibility of using nonconforming grids between the subdomains may then be appealing. Another application of nonconforming grids is the simulation of rotating engines through sliding meshes. The aim of this symposium is to present different aspects of such an approximation (theory, fast solvers, numerical simulations).

BUFFA, Annalisa (University of Pavia, Italy) *The mortar element method for the 2D and 3D simulation of Maxwell's equations* (p. 172)
HOPPE, Ronald H W (Institute of Mathematics, University of Augsburg, Germany) *Adaptive mortar edge element methods in the computation of eddy currents* (p. 172)
MAGOULÈS, Frédéric (Office National d'Études et de Recherches Aérospatiales, France) *A method of finite element tearing and interconnecting for the Maxwell equations* (p. 172)
RAPETTI, Francesca (ASCI, CNRS, France) *Simulating Eddy currents distributions by a finite element method on moving non-matching grids* (p. 172)
WIDLUND, Olof B (Courant Institute, USA) *Schwarz Methods for $H(div)$ and $H(curl)$ finite element problems* (p. 173)

MSP-201 Adam Ferguson Building, Room 19

Absorbing Boundary Conditions

Organisers: KRÖNER, Dietmar (Institut für Angewandte Mathematik, Freiburg, Germany)
SOFRONOV, Ivan (Keldysh Institute of Applied Mathematics, Moscow, Russia)

For numerical simulations of problems involving partial differential equations in unbounded domains one has to perform the computation on a bounded domain (usually). Therefore artificial (absorbing, transparent or non-reflecting) boundary conditions are necessary. Several ideas have been used. There is the theory based on pseudo differential operators which tries to cancel all incoming waves. Another possibility is to consider linearized equations outside the computational domain which can be explicitly solved by analytical or/and numerical methods yielding matrices to update solution on an artificial boundary in a course of an iteration process. The aim of this minisymposium is to bring together recent developments for getting absorbing boundary conditions for different classes of problems.

SOFRONOV, Ivan (Keldysh Institute of Applied Mathematics, Russian Academy of Sciences, Russia) *Artificial boundary conditions on the basis of exact solution to the linearized euler equations* (p. 185)
GROTE, Marcus J (ETH Zürich, Switzerland) *Nonreflecting boundary conditions for electromagnetic and elastic waves* (p. 184)
SPECOVIUS-NEUGEBAUER, Maria (University of Paderborn, Germany) *Artificial boundary conditions for elliptic problems in systems of channels* (p. 185)
PETROPOULOS, Peter G (Department of Mathematical Sciences, New Jersey Institute of Technology, USA) *Reflectionless sponge layers for 3D electromagnetic waves: A review* (p. 185)

MSP-204 Adam Ferguson Building, Room 10
Second Order Analysis of Optimal Control Problems II
(see also Part I, MSP-203, p. 160)

Organiser: BONNANS, J Frédéric (INRIA-Rocquencourt, France)

MAURER, Helmut (Westfälische Wilhelms-Universität Münster, Institut für Numerische Mathematik, Germany) *Second order sufficient conditions for optimal control problems with free final time* (p. 186)
RAYMOND, Jean-Pierre (Lab. MIP, Universite Paul Sabatier, Toulouse, France) *Second order sufficient optimality conditions for nonlinear parabolic control problems with state constraints* (p. 186)
BONNANS, J Frédéric (INRIA-Rocquencourt, France) *Second order analysis of optimal control problems with second order state constraints* (p. 186)

MSP-216 William Robertson Building, Seminar Room 2
Nonlinear Waves III
(see also Part I, MSP-214, p. 146; Part II, MSP-215, p. 160)

Organisers: CHEN, Min (Penn State University and University of Texas at Austin, USA)
BONA, Jerry (Univercity of Texas, Austin, USA)

SHEN, Sam (University of Alberta, Canada) *Forced evolution equations, bifurcation, stability, and collision of uniform solitons* (p. 193)
GROVES, Mark D (Dept of Math, Loughborough University, UK) *Hamiltonian spatial dynamics methods for two and three-dimensional steady water waves* (p. 192)
ZHANG, Bingyu (University of Cincinnati, USA) *Forced oscillation and its global stability* (p. 193)

MSP-220 William Robertson Building, Seminar Room 10
Self-Focusing: Theory and Applications II
(see also Part I, MSP-219, p. 160)

Organiser: FIBICH, Gadi (Tel-Aviv University, Israel)

GAETA, Alexander L (School of Applied and Engineering Physics, Cornell University, USA) *Nonlinear propagation of ultrashort laser pulses in dispersive media* (p. 195)
MOLONEY, Jerome V (University of Arizona, USA) *Role of the critical collapse singularity in sustaining a novel femtosecond light guide* (p. 196)
WANG, Xiao-Ping (Department of Mathematics, Hong Kong University of Science & Technology, Hong Kong) *A moving mesh method and applications to self-focusing problems* (p. 196)
LEVY, Doron (Department of Mathematics, UC Berkeley and LBNL, USA) *Self-focusing in the complex Ginzburg-Landau limit of the critical nonlinear Schrödinger equation* (p. 195)
CHRISTIANSEN, Peter L (Department of Mathematical Modelling, Technical University of Denmark) *Self-focussing in discrete, disordered and noisy media* (p. 195)

MSP-233 William Robertson Building, Seminar Room 11

Computational Methods for Microstructures and Modelling of Materials

Organisers: CARSTENSEN, Carsten (Mathematisches Seminar der Christian-Albrechts-Universität zu Kiel, Germany)
PLECHÁČ, Petr (University of Delaware, USA)

The aim of the minisymposium is to present some recent approaches to computations and numerical approximation of fine structures (microstructures) in non-convex minimisation models. Such a variational framework provides only generalised solutions, described by Young measures, which are only of limited use for numerical analysis of the problem. The physical models involve multiple scales and describe, e.g., phase transitions in elastic or ferromagnetic materials. The resolution of fine scales is a common difficulty in many applications and a challenging task from both computational and analytical point of view. The relaxation of the variational formulation provides a model where the micro-mechanics is not resolved, however, the macroscopic quantities can be approximated and the numerical error controlled. We will discuss recent developments in a priori and a posteriori error analysis with conforming and non-conforming finite element methods. Understanding and modelling the coupling of different scales is important for describing mechanisms behind hysteresis. The time dependent problems lead to modelling of the motion of interfaces which separate regions with developed microstructure. Some approaches to computation of interface motion will be discussed as well.

CARSTENSEN, Carsten (University of Kiel, Germany) *Numerical Analysis of a non-convex variational problem in micromagnetics* (p. 203)
ELLIOTT, Charlie (University of Sussex, UK) *Tba*
LUSKIN, Mitchell (University of Minnesota, USA) *Theory and computation for the microstructure at the interface between twinned layers of Martensite and a pure variant* (p. 204)
PLECHÁČ, Petr (University of Delaware, USA) *Numerical approximation of microstructure with scales* (p. 204)
PROHL, Andreas (Christian-Albrechts-Universitaet Kiel, Germany) *On different finite element methods for computing crystalline microstructures* (p. 204)

MSP-245 David Hume Tower, Faculty Room North

Pulsed Beams and Physical Wavelets in Acoustics and Electromagnetics

Organisers: KAISER, Gerald (Virginia Center for Signals and Waves, USA)
HEYMAN, Ehud (Tel Aviv University, Israel)

Complex source pulsed beam (CSPB) solutions of the wave and Maxwell equations have been introduced by Heyman, Steinberg and Felsen beginning 1987. The closely related acoustic and electromagnetic wavelets were introduced by Kaiser in 1994. Formally, these solutions are fields emitted by point sources located in complex space-time. We intend to give a brief review and address the following topics: 1. Physical realizability by source distributions in real space-time. 2. Application to the descriptions of local wave interactions with environments (e.g., dielectric interfaces, diffraction by wedges, propagation in inhomogeneous media, local interrogation). 3. Complete bases for phase space analysis and synthesis of solutions and physics-based data processing, contrasted with the usual plane-wave and Green function methods.

KAISER, Gerald (Virginia Center for Signals and Waves, USA) *Realizability of acoustic and electromagnetic wavelets by real source distributions* (p. 212)
HEYMAN, Ehud (Tel Aviv University, Israel) *Exact and local solutions for pulsed beam propagation and scattering* (p. 212)
STEINBERG, Ben Zion (Tel Aviv University, Israel) *Local spectral expansions using pulsed beams* (p. 212)

MSP-251 David Hume Tower, Lecture Theatre C

Plate and Shells: Asymptotic Methods

Organisers: DAUGE, Monique (Universite de Rennes 1, France)
PITKÄRANTA, Juhani (University of Helsinki, Finland)

This minisymposium is devoted to linearized equations on thin plates and shells. Our aim is the investigation of solutions by optimal asymptotic expansions and their numerical approximation by higher order methods, mainly hierarchical models and p-version of finite elements. We decided to reserve the talks for young and high-level PhD students and doctors. They are excellent representatives of several well-known groups working on such topics in the world.

RÖSSLE, Andreas (Mathematical Institute A, University of Stuttgart, Germany) *Higher order responses of thin linearly elastic plates and their visualization* (p. 216)
MARDARE, Cristinel (University of Paris VI, France) *New error estimates in the theory of elastic shells* (p. 215)
FAOU, Erwan (IRMAR, Univertsité de Rennes 1, France) *Complete asymtotic for linear elastic clamped elliptic shell* (p. 215)
HAKULA, Harri (Helsinki University of Technology, Finland) *Resolving characteristic length scales in thin shells using high-order FEM* (p. 215)
MADUREIRA, Alexandre L (Pennstate University, USA) *Error estimates for hierarchical modeling* (p. 215)
MOTYGIN, Oleg (Inst of Mech Engrng Problems) *A suitable for computer realization method for boundary layer construction in the theory of thin plates* (p. 216)

MSP-254 Appleton Tower, Lecture Theatre 2
Aeroacoustics

Organiser: CAMPOS, L M B C (Instituto Superior Tecnico, Lisboa, Portugal)

This Mini-symposium includes talks on analytical and computational methods in aeroacoustics.

PIERCE, Allan D (ENG Aero & Mech Engineering, Boston University, USA) *The sound in and around a cavity due to grazing flow: a new method of calculation* (p. 217)
ROGER, Michel (Ecole Centrale de Lyon, LMFA, UMR, CNRS Ecully, France) *Analytical modelling of airfoil trailing-edge and self-noise for industrial applications* (p. 217)
MOHRING, Willi (Max-Planck-Institut fur Dtomungsforschung Gottingen, Germany) *Energy conservation and reciprocity for sound propagation in layered flows* (p. 216)
CAMPOS, L M B C (I S T - S M Aeroespacial, ISR, Lisboa, Portugal) *On sound scattering by sheared flows, including shear layers, boundary layers and duct modes* (p. 216)

MSP-263 Management School, Lecture Theatre 1
Centre for Applied and Industrial Mathematics in Scotland (AIMS)

Organiser: MCKEE, Sean (University of Strathclyde, Glasgow, UK)

The Centre for Applied and Industrial Mathematics in Scotland (AIMS) was founded in 1995 by the organiser together with F Leslie and D Sloan. It is a loose grouping of certain members of all mathematics departments in Scotland interested in working on industrial problems. A coordinator, Chris Robbins, is based at the University of Strathclyde. Key members of this group will discuss selected problems.

LACEY, Andrew A (Heriot-Watt University, Edinburgh, UK) *Modelling moisture and temperature variation in sugar silos* (p. 223)
PARKER, David F (University of Edinburgh, UK) *Surface layers in electrochemical machining problems* (p. 223)
WILSON, Stephen K (University of Strathclyde, Glasgow, UK) *Some industrially-motivated problems involving thin fluid films* (p. 223)
ROBBINS, Chris (University of Strathclyde, UK) *Discrete element simulation and its application to fire safety and evacuation* (p. 223)

MSP-266 Appleton Tower, Seminar Room 8
Dynamical Systems in Manufacturing IV
(see also Part I, MSP-083, p. 122; Part II, MSP-084, p. 142; Part III, MSP-085, p. 155)

Organisers: BLACKMORE, Denis (New Jersey Institute of Technology, USA)
SAMOILENKO, Anatoliy M (Institute of Mathematics, National Academy of Sciences, Ukraine)
PRYKARPATSKY, Anatoliy K (AGH, Poland and Dept. of Nonlin. Mathem. Analysis, IAPMM of the NAS, Lviv, Ukraine)

SIDORENKO, Yuriy M (Lviv State University, Ukraine) *Binary transformations and exact solutions for multidimensional integrable systems* (p. 87)
ROSATO, Anthony D (New Jersey Institute of Technology, USA) *Dynamical features of vibrating beds of granular materials* (p. 85)
PERESTIUK, Mykolay M (Dept. of Mathematics and Mechanics of the Kyiv State University, Kyiv, Ukraine) *Stability of invariant torus for impulsive systems* (p. 84)

MSP-268 Management School, Lecture Theatre 4
Integrating Symbolic and Numeric Computations: Algorithms and Software II
(see also Part I, MSP-267, p. 163)

Organisers: MORENO MAZA, Marc (The Numerical Algorithms Group Ltd, UK)
GONZALEZ-VEGA, Laureano (Universidad de Cantabria, Spain)

ROUILLIER, Fabrice (Projet Polka, INRIA, France) *Real Solving of Polynomial Systems and Applications*
TRAVERSO, Carlo (Department of Mathematics, Pisa, ITALY) *Integrating symbolic and numeric computations with the PoSSo library* (p. 226)
MORENO MAZA, Marc (The Numerical Algorithms Group Ltd, UK) *Using Aldor: Triangular decompositions of polynomial systems and applications*

15.20 – 16.20 Congress Review and Closing Ceremony

Congress Review and Closing Ceremony
McEwan Hall

The Congress serves a dual purpose in that it allows the experts in a particular areas to meet, talk and understand the research developments in their speciality but also it gives an overview of the way in which applied and industrial mathematics is developing. In the Congress Review, three of the participants at the Congress, Marco Avellaneda (Courant Institute), Hilary Ockenden (Univeristy of Oxford), and Robert Mattheij (Eindhoven University) outline the results that they have felt were most interesting and important. This will be followed by the invitation to attend ICIAM 2003 in Sydney, Australia, and the formal closing of the Congress.

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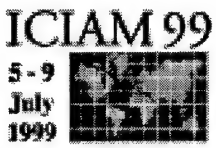


General Information

Registration

The congress registration desks, located in the Chaplaincy Centre, will be open during the following times each day to provide information and general assistance to all delegates.

Sunday 4 July	14:00–20:00
Monday 5 July	08:00–18:00
Tuesday 6 July	08:00–18:00
Wednesday 7 July	08:00–18:00
Thursday 8 July	08:00–18:00
Friday 9 July	08:00–16:30

On registering you will have received a congress bag and materials, including a congress badge permitting access to the Welcome Reception, Opening Ceremony, the Congress Reception, Exhibition and all congress sessions. Registered accompanying guests have also been issued with a badge for admission to the Welcome Reception, the Congress Reception, the Film Evening and the Accompanying Guests Excursions (at additional cost). Please note accompanying guests are not permitted to attend the Opening Ceremony or scientific sessions.

For security purposes it is essential that you wear your congress badge at all times. This is of particular importance on Monday 5 July when HRH The Duke of Edinburgh shall attend the Opening Ceremony. Congress badges are colour coded as follows:

White	Delegates/Speakers
Pink	Accompanying Guests
Green	Exhibition Staff
Yellow	Organisers/Stewards

Information Desks

Information about *all aspects* of the Congress can be obtained from staff at the Chaplaincy Centre. In addition, there will be a welcome/help desk at Pollock Halls on Sunday 4th July to provide assistance.

Bank Services

The nearest bank to the congress site can be found at: The Bank of Scotland, 4 Bristo Square, Edinburgh, EH8 9AL. Opening Hours: 09:00–17:00 Monday to Friday. This bank is located immediately adjacent to the Chaplaincy Centre.

Exchange facilities can also be found at many other banks located throughout the city centre or alternatively at Waverley Train Station and airports.

Messages for Congress Participants

For incoming messages to participants please use telephone and fax numbers provided in your registration pack and on the web site. All messages will be posted on a message board located in the Chaplaincy Centre. Messages for congress participants and exhibitors can be left via this number but please note it is not possible to contact participants or exhibitors by telephone directly. All faxes must clearly display ICIAM99 and the name of the recipient.

Participants wishing to exchange personal messages during ICIAM99 should use the message board in the Chaplaincy Centre.

E-Mail Service

Email access is available in the Computing Laboratory on Level 5 of Appleton Tower during the following times:

Monday 5 July	08:00–18:00
Tuesday 6 July	08:00–18:00
Wednesday 7 July	08:00–18:00
Thursday 8 July	08:00–18:00
Friday 9 July	08:00–15:00

Programme Changes

An updated daily programme will be available at each of the main Congress venues and on the internet.

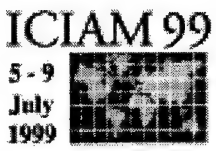
Conference Proceedings

Plenary lectures and a Congress report will be published by Oxford University Press. A copy will be sent to all fully registered members of the Congress (except students).

Photocopying and Fax Facilities

Should you wish to send a fax or make a photocopy please contact the registration staff who will be delighted to assist you. A small charge shall be made for this service as follows:

Photocopying	10p per sheet
Fax — National	50p per sheet
Fax — International	£1.00 per sheet



Social Programme

Sunday 4 July — Welcome Reception, Teviot Row House 18:00–20:00. All delegates, registered accompanying guests and exhibitors are invited to attend the welcome reception to be held in Teviot Row House on the Congress site. Wine and soft drinks will be served, giving guests the opportunity to meet colleagues in a convivial atmosphere. This reception is kindly sponsored by Oxford University Press.

Tuesday 6 July — Congress Reception, Royal Museum and Museum of Scotland 19:00–20:30. Regarded as one of Scotland's finest museums, delegates, exhibitors and registered guests will have the opportunity to view the many fine treasures housed in this beautiful building. There will also be an opportunity to view the newly completed Museum of Scotland which adjoins the existing museum. The Museum of Scotland depicts the history of Scotland — its land, its people and their achievements. Scotland's most stunning treasures and the inheritance of a nation are displayed in this fine example of modern architecture. Wine and soft drinks will be available at this reception which is generously sponsored by Cambridge University Press.

Wednesday 7 July — Scottish Evening, Teviot Row House 20:00–24:00. An evening of Scottish Entertainment awaits combining traditional Scottish food and wine with Scottish folk music and ceilidh dancing. During the evening delegates will have the opportunity to sample Scotland's favourite dish - haggis, neeps and tatties — followed by a chance to participate in traditional Scottish country dancing. For those less energetic there will be a variety of entertainment throughout the building including craft stalls and musicians. If you would like to attend the Scottish Evening but have not already reserved a place, please enquire at the Chaplaincy Centre — tickets may still be available subject to demand.

Thursday 8 July — Film Evening, George Square Lecture Theatre 20:00–21:30. The selected film for this evening is Mrs Brown, a historical drama charting the unlikely and (at the time) scandalous friendship forged by the grieving Queen Victoria and a devoted Scottish servant. With Judi Dench and Billy Connolly. This evening is open to all delegates and registered guests, but please note that places are limited to 500 and entry will be on a first come first served basis on the evening.

Accompanying guests' excursions

All excursions will depart from the front of Appleton Tower on the days and times shown. Tickets may still be available for these tours — please contact the Tour desk in the Chaplaincy Centre for further details.

Tuesday 6 July — St. Andrews and Fife (£28 per person) 09:00–17:00. Departing from Edinburgh and travelling north over the River Forth with spectacular views of the century-old rail bridge, you will pass through the picturesque fishing villages of Fife before reaching St. Andrews, home of golf and Scotland's oldest University. On the return journey you will visit Falkland Palace, a favourite house of Mary, Queen of Scots. Please note lunch is not included in this tour.

Thursday 8 July — The Highlands in Miniature (£28 per person) 09:00–17:30. This tour includes a visit to Stirling Castle, the centre of an area made famous by Rob Roy and Braveheart. Then on to Callander and through the Trossachs, a region of mountains and lochs, before reaching the village of Aberfoyle where you can visit a woollen mill. The return journey includes a short visit to the beautifully scenic Loch Lomond. Please note lunch is not included in this tour.

Eating and Refreshments

Tea/Coffee Breaks

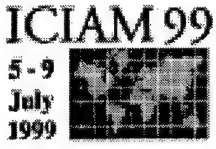
Complimentary tea and coffee will be available during the morning and afternoon breaks at the following venues. The morning breaks are between 10:30–11:00 on Monday, 10:40–11:00 on Tuesday, Wednesday and Thursday, and between 9:45–10:05 on Friday. The afternoon breaks are between 15:40–16:00 Monday to Thursday and between 15:00–15:20 on Friday.

- Appleton Tower Concourse
- Teviot Row House
- David Hume Tower Basement
- Management School Foyer
- George Square Lecture Theatre Basement
- William Robertson Building Foyer

Lunch

Lunches will be on sale in the following locations at reasonable prices:

- Appleton Tower Concourse
- Teviot Row House
- David Hume Tower Basement Cafeteria
- Potterow Bar, Chaplaincy Centre Courtyard



Information for Speakers

All lecture rooms have an overhead projector and 35mm slide projector and screen. Rehearsal facilities are available in the Speakers Preview Room and additional slide trays may be obtained from this room.

Speaker Preview Room

This is located in the Lecturer's Retiring Room in the Appleton Tower. It will be open at the following times:

Sunday 4 July	14:00–18:00 hours
Monday 5 July	08:30–18:00 hours
Tuesday 6 July	08:30–18:00 hours
Wednesday 7 July	08:30–18:00 hours
Thursday 8 July	08:30–18:00 hours
Friday 9 July	08:30–16:00 hours

To avoid congestion in the preview room the organisers request that preview facilities be used one day in advance of scheduled presentations. OHP acetates and pens will be on sale. Additional slide trays may be obtained on the payment of a small deposit.

Information for Poster Presenters

Posters will be displayed in the David Hume Tower Lower Foyer. All posters must be set-up between 08:30 and 10:30 on the day of presentation and removed by 18:00. Please note all boards are 2m wide × 1m high. Posters can be attached using Velcro which will be available in the poster area during the set-up times shown above. Help will be on hand during the set-up times to assist you in locating your poster board. Presenters should spend a reasonable proportion of the time between 10:30 and 14:00 with their posters.

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Additional Scientific Events

Meetings

There will be a Symposium on Mathematics and the Law and Four Lectures on Maxwellian Themes at the Royal Society of Edinburgh (22–26 George Street) which is about 25 minutes walk from the main Congress site.

The Symposium on **Mathematics and the Law** is on Wednesday 7th July, 17:00 – 20:00 and is sponsored by the Royal Society of Edinburgh and the Faculty of Advocates. Mathematics and the law are closely related subjects. Both have a logical basis. Some of those with a mathematical training go on to be lawyers. But can mathematics influence law? In this symposium, four illustrations of the relationship between mathematics and the law are given: one concerns actuarial ideas, one the laws of mathematics, one considers the possibilities for modelling legal reasoning using computers and one considers the role of probability in the law. As well as the four lectures, there will be plenty of time for discussion. The lectures are:

- Sir Michael Ogden, Q.C., *How actuaries put the law right.*
- Mr. G. Staple, Q.C., *The laws of mathematics and the rule of law.*
- Professor R. Susskind, *Computational models of legal reasoning?*
- Dr. C.G.G. Aitken, *The interpretation of probabilistic evidence.*

The meeting on **Maxwellian Themes**, which is jointly organised by the International Centre for Mathematical Sciences and the James Clerk Maxwell Foundation, is on Friday 9th July 17:00 – 19:30 and Saturday 10th July 10:30 – 13:00. A series of four lectures, aimed at a general audience, illustrating the range of Maxwell's influence on modern theory and modern technology. The schedule is

Friday 9th July

5:00 pm Francis Everitt (Stanford University, and Chair of Scientific Commission H on Fundamental Physics in Space, COSPAR), *Testing Einstein in space: a marriage of physics and technology.*

6:00 pm Tea.

6:30 pm Peter Higgs (Emeritus Professor of Theoretical Physics, University of Edinburgh), *Beyond electromagnetism: Maxwellian field theories in the 20th century.*

Saturday 10th July

10:30 am Malcolm Longair (Jacksonian Professor of Natural Philosophy, University of Cambridge), *A Maxwellian approach to modern cosmology.*

11:30 am Coffee.

12:00 am Will Stewart (Chief Scientist with Marconi Materials Technology), *Photonic crystals: Maxwellian photons and heavy electrons.*

Special Interest Days

The Faculty and the Institute of Actuaries have organised in conjunction with ICIAM99 a one day event on Tuesday 6th July for all those interested in **financial mathematics**. Marco Avellaneda will deliver a Plenary lecture entitled *New Perspectives in Modelling Financial Risk.* He will also chair an informal discussion (09:30–10:30 in the William Robertson Building, Lecture Theatre 8) on *Long Term Capital Management — $4000m to $600m in a matter of days — what went wrong?* There will also be mini-symposia on Risk Management (MSP-232) and Quasi-Monte Carlo Methods for Finance Applications (MSP-235).

On Thursday 8th July, the Edinburgh Parallel Computing Centre (EPCC) will be holding a one day meeting on the use of **parallel computing** throughout academia, industry and commerce, as part of ICIAM99. The events are a plenary lecture by Anthony Kennedy entitled *Do Large Computations Solve our Problems or Cause them?*, two EPCC lectures — by Jack J. Dongarra, *Scalable High-Performance Libraries in Linear Algebra*, and by Siamak Hassanzadeh, *Java Grande: A Framework for High-End Computing in the "Information Utility" Era*, and six mini-symposia MSP272 — MSP277.

Prizes

CICIAM Prizes

The following CICIAM prizes have been established to recognise outstanding achievements in applied mathematics. The presentation for these prizes is on Monday, 5th July at the Opening Ceremony in McEwan Hall.

- The CICIAM Lagrange Prize, funded by the Société des Mathématiques Appliquées et Industrielles (SMAI), the Sociedad Española de Matematica Aplicada (SEMA) and the Societá Italiana di Matematica Applicata e Industriale (SIMAI), has been established to provide international recognition to individual mathematician who have made an exceptional contribution to applied mathematics throughout their careers.
- The CICIAM Lothar Collatz Prize, funded by the Gesellschaft für Angewandte Mathematik und Mechanik (GAMM), has been established to provide international recognition to individual scientists under 42 years of age for outstanding work on industrial and applied mathematics.
- The CICIAM SIAM Pioneer Prize, funded by The Society for Industrial and Applied Mathematics (SIAM), is for pioneering work introducing applied mathematical methods and scientific computing techniques to an industrial problem area or a new scientific field of applications.
- The CICIAM Maxwell Prize, funded by the Institute of Mathematics and its Applications (IMA) and the James Clerk Maxwell Foundation, has been established to provide international recognition to a mathematician who has demonstrated originality in applied mathematics.

Dahlquist Prize

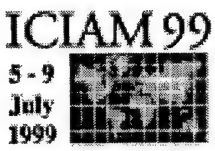
The Dahlquist Prize, established by SIAM in 1995, is awarded to a young scientist for original contributions to fields associated with Germund Dahlquist, especially the numerical solution of differential equations and numerical methods for scientific computing. The 1999 Dahlquist Prize will be awarded to Linda Petzold for her important contribution to effective numerical methodology for differential equations, especially the analysis of methods for differential-algebraic equations, the construction of effective techniques for their solution, and the integration of these and other techniques into robust software, thus making possible the reliable solution of large classes of ordinary and partial differential equations arising from engineering and science applications. The presentation for the 1999 Dahlquist Prize is at 09:45 on Tuesday, 6th July in McEwan Hall.

Peter Henrici Prize

The Peter Henrici Prize is awarded for original contributions to applied analysis and numerical analysis and/or for exposition appropriate for applied mathematics and scientific computing. The award is intended to recognise broad and extended contributions to these subjects, more than a single outstanding work.
The first Peter Henrici Prize will be presented at the ICIAM meeting. This Prize, sponsored by SIAM and ETHZ, is to be given to honour Peter Henrici who was such an eminent figure in Applied Mathematics and Numerical Analysis. In addition to all his scientific achievements, he wrote numerous books and papers in an elegant manner, communicating ideas coherently and logically.
The winner of the Henrici Prize will be announced and presented with the award at 09:45 on Wednesday, 7th July in McEwan Hall.

The Wilkinson Prize for Numerical Software

The Wilkinson Prize for Numerical Software was established in honour of the outstanding contributions of James Hardy Wilkinson to the field of numerical software. The prize is jointly sponsored by Argonne National Laboratory, where Wilkinson was a frequent visitor; the National Physical Laboratory, where Wilkinson spent most of his working life; and The Numerical Algorithms Group, for whom Wilkinson gave great encouragement and support. The previous two prizes were awarded at ICIAM91 and ICIAM95. The Web address for the Wilkinson Prize is http://www.nag.co.uk/other/WilkinsonPrize.html.
The winner of the Wilkinson Prize will be announced and presented with the award at 09:45 on Thursday, 8th July in McEwan Hall and will give a lecture in the mini-symposium MSP-137 at 11:00 Thursday 8th July.



Organisation

ICIAM99 is jointly organised by the Institute of Mathematics and its Applications and the International Centre for Mathematical Sciences, with the involvement of Mathematics Departments at Edinburgh University and Heriot-Watt University. The Chairman of ICIAM99 is Sir Michael Atiyah, O.M.

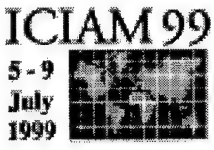
The Committee for International Conferences on Industrial and Applied Mathematics (CICIAM) is an international association of societies involved in applied mathematics and its applications. The main activity of CICIAM is to hold a four yearly international congress. The present chair of CICIAM is Professor R. Mennicken (Germany). A full list of Member Societies of CICIAM is given in the front of this book.

The Local Organising Committee consists of Lyn Thomas (convener), Jack Carr, Robin Knops, Elmer Rees, Michael Levitin and Adri Olde Daalhuis.

The scientific programme and, in particular, the selection of invited speakers lies in the hands of an international Scientific Programme Committee chaired by J.C.R. Hunt (UK).

Scientific Programme Committee: Julian Hunt (Chairman, UK), Angelo M Anile (Italy), Tim Auton (UK), Noel Barton (Australia), Franco Brezzi (Italy), Roland Bulirsch (Germany), Ranier Burkard (ECMI), Da Yong Cai (China), Jack Carr (UK), Qian Sheng Cheng (China), Alexandre Chorin (USA), Iain S Duff (UK), Wayne Enright (Canada), G Golitsyn (Russia), Bertil Gustafsson (Sweden), J Jacod (France), Adrien Jami (France), Peter King (UK), Dr Edwin Kreuzer (Germany), Robert Mattheij (ECMI), Perla Menzala (Brazil), Robert Miura (Canada), Masatake Mori (Japan), John Ockendon (UK), David F Parker (UK), Jacques Periaux (France), Juhani Pitkaranta (Finland), J Rappaz (Switzerland), J M Sanz Serna (Spain), Norihisa Suzuki (Japan), Ernie Tuck (Australia), Martin Tygel (Brazil), J L Vazquez (Spain) and Mary F Wheeler (USA).

The ICIAM99 Congress Secretariat is Meeting Makers Ltd, who can be contacted at Jordanhill Campus, 76 Southbrae Drive, Glasgow G13 1PP, UK, tel: +44 (0)141 434 1500, fax: +44 (0)141 434 1519, email: iciam@meetingmakers.co.uk



Accommodation

Contact telephone and fax numbers are given below for each of the designated conference hotels and university residencies.

University accommodation

University of Edinburgh. The accommodation at Pollock Halls is approximately 15 minutes' walk from the University of Edinburgh George Square Campus. Tel: 0131 667 0662. Fax: 0131 662 9479.

Heriot Watt University. This university accommodation is approximately 20-25 minutes by coach from the main congress centre. Tel: 0131 449 5111. Fax: 0131 451 3199.

Self-Catering Flats. These flats are located at Kincaid Court, Hermit's Croft and Warrender Park Crescent. All flats are within walking distance of the congress site. Please use the telephone numbers given above for the University of Edinburgh should you need to contact accommodation services regarding these flats.

Hotel accommodation

Apex European Hotel
90 Haymarket Terrace
Edinburgh EH12 5LQ
Tel: 0131 474 3456
Fax: 0131 474 3400

Apex International Hotel
31-35 Grassmarket
Edinburgh EH1 2HS
Tel: 0131 300 3456
Fax: 0131 220 5345

Carlton Highland Hotel
North Bridge
Edinburgh EH1 1SD
Tel: 0131 472 3000
Fax: 0131 556 2691

Edinburgh City Travel Inn
1 Morrison Link
Edinburgh EH3 8DN
Tel: 0131 228 9819
Fax: 0131 228 9836

Forte Posthouse
Corstorphine Road
Edinburgh EH12 6UA
Tel: 0131 334 0390
Fax: 0131 334 9237

Herald House
70 Grove Street
Edinburgh EH3 8AP
Tel: 0131 228 2323
Fax: 0131 228 3101

Holiday Inn Crowne Plaza
80 High Street, The Royal Mile
Edinburgh EH1 1TH
Tel: 0131 557 9797
Fax: 0131 557 9789

Holiday Inn Garden Court
Queensferry Road
Edinburgh EH4 3HL
Tel: 0131 332 2442
Fax: 0131 332 3408

Jarvis Mount Royal
Princes Street
Edinburgh EH2 2DG
Tel: 0131 225 7161
Fax: 0131 220 4671

King James Thistle
107 Leith Street
Edinburgh EH1 3SW
Tel: 0131 556 0111
Fax: 0131 557 5333

Kings Manor
100 Milton Road East
Edinburgh EH15 2NP
Tel: 0131 669 0044
Fax: 0131 669 6650

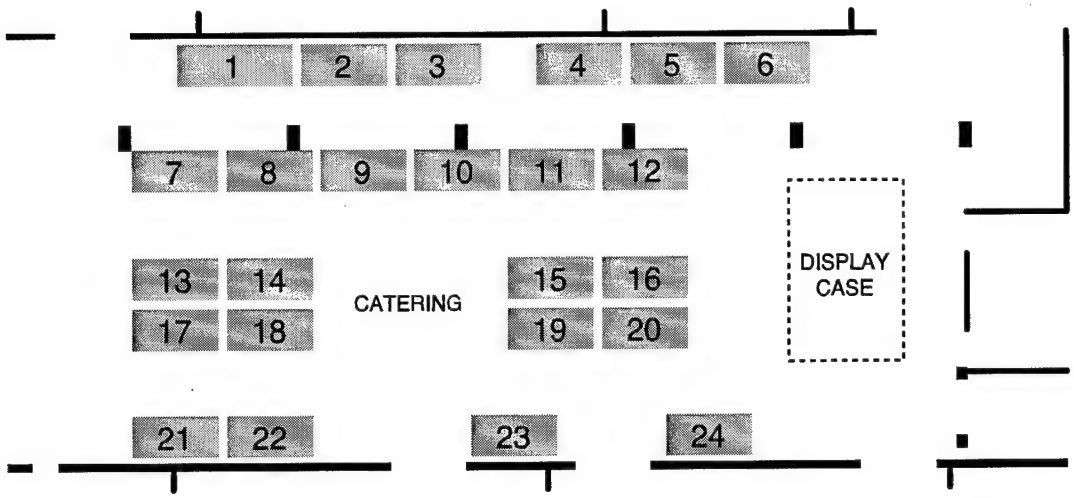
Maitland Hotel
33 Shandwick Place
Edinburgh EH2 4RG
Tel: 0131 229 1467
Fax: 0131 229 7549

Parliament House Hotel
15 Calton Hill
Edinburgh EH1 3BJ
Tel: 0131 478 4000
Fax: 0131 478 4001

Point Hotel
34 Bread Street
Edinburgh EH3 9AF
Tel: 0131 221 9919
Fax: 0131 221 9929

Royal British
20 Princes Street
Edinburgh EH2 2AN
Tel: 0131 556 4901
Fax: 0131 557 6510

Royal Terrace
18 Royal Terrace
Edinburgh EH7 5AQ
Tel: 0131 557 3222
Fax: 0131 557 5334



Floor plan of the exhibition area

ICIAM 99
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Exhibition Information

ICIAM99 would like to thank the undernoted companies for supporting the Congress Exhibition. We invite you to visit each of their stands during the Congress and view their websites - details are given below. All exhibition stands are located in the Appleton Tower Concourse. The opening hours of the exhibition will be as follows:

Monday 5 July	10:30–18:00
Tuesday 6 July	10:40–18:00
Wednesday 7 July	10:40–18:00
Thursday 8 July	10:40–18:00
Friday 9 July	09:45–15:30

In the following descriptions, the number shown relates to the stand number.

- **1. Society for Industrial and Applied Mathematics (SIAM)**

  3600 University City Science Center
  Philadelphia, PA 19104-2688, USA
  Tel: +1 215 383 9800
  Fax: +1 215 386 7999
  Email: siam@siam.org
  http://www.siam.org
  Contact: Vickie Kearn, Publisher

  SIAM is a non-profit society of more than 9000 professional mathematicians. At our exhibit, we will have information on all our publications and services and you will be able to take advantage of a special 18 month membership offer. Come and see sample issues of all of our journal and information about our forthcoming conferences. ICIAM99 attenders receive a discount on SIAM books. There are many new titles for you to consider. We have a new T-shirt with our mascot on it and free post-it notes for you to take as a souvenir of the meeting.

- **2. London Mathematical Society**

  De Morgan House
  57–58 London Square, London WC1B 4HP, UK
  Tel: 0171 291 9977
  Fax: 0171 323 3655
  Email: lms@lms.ac.uk
  http://www.lms.ac.uk

  The society was established for the promotion and extension of mathematical knowledge. To this end the Society undertakes various publications and holds regular meetings, conferences and symposia. It is the major British learned society for Mathematics, with a nationwide membership. It also has several hundred overseas members and is a registered charity. The Society publishes 3 long-established research periodicals, the Proceedings, the Journal and the Bulletin, all of which appear bimonthly and publish papers across a broad range of mathematics.

- **3. John Wiley and Sons Ltd**

  Baffins Lane, Chichester
  West Sussex, PO19 1UD, UK
  Tel: 01243 770 570
  Fax: 01243 770 432
  Email: cs-books@wiley.co.uk

http://www.wiley.co.uk
Contact: Rebecca Harfield

John Wiley and Sons Ltd is a leading international publisher of print and electronic products, specialising in scientific/technical books and journals. Visit our stand at ICIAM99 and view our range of latest publications in the fields of Industrial and Applied Mathematics. Highlights include Queuing Networks by X. Chao and Theory and Algorithms for Linear Optimisation by C Roos, all offered at a special conference discount of 15%. FREE sample copies from our extensive range of specialist journals including Mathematical Methods in the Applied Sciences, Journal of Scheduling and International Journal for Numerical Methods in Engineering.

- **4 & 5. Jaguar**

  Jaguar Research W/2/021
  Engineering Centre, Whitley
  Coventry, CV3 4LF, UK
  Tel: +44 (0)1203 214313
  Fax: +44 (0)1203 216533
  Email: hwillia6@ford.com

- **6. Chapman & Hall/CRC Press**

  Pocock House
  235 Southwark Bridge Road
  London, SE1 6LY, UK
  Tel: +44 171 450 5083
  Fax: +44 171 407 7336
  http://www.crcpress.com
  Contact: Alison West

  Chapman & Hall/CRC is one of the world's largest reference and advanced textbook publishers in mathematics and statistics. In 1999 we are publishing over 50 new titles including new editions of best-selling textbooks, new titles in established reference series and electronic versions of products not previously available. Among our publications this year we are proud to announce the publication of Mollin's Algebraic Number Theory and the second edition of Nguyen and Walkers's A First Course in Fuzzy Logic. In the Research Notes in Mathematics series, we have just published Stability, Instability and Direct Integrals by Scarpellini, and in the Monographs and Surveys in Pure and Applied Mathematics series, Bullen's Dictionary of Inequalities.

- **7. ICIAM 2003, Sydney, Australia**

  GPO Box 2609
  Sydney
  New South Wales 2001, Australia
  Tel: (612) 9241 1478
  Fax: (612) 9251 3552
  Email iciam@icmsaust.com.au
  http://www.austms.org.au/iciam2003
  Contact: Dr Noel Barton, Congress Director

  ICIAM 2003 will be held in Sydney, 7-11 July, 2003 in the Sydney Convention and Exhibition Centre, just minutes from Sydney's central business and shopping district. We promise an exciting program, social activities and trade exhibition.

  Enhance life's tapestry; attend ICIAM 2003 and also experience other delights of Sydney and Australia - the Blue Mountains, one of the many excellent wine regions, the Great Barrier Reef, the Red Centre, Tasmania and many more. For further information on the Congress and suggestions for the trip to Australia, visit us on Stand 7 and get a taste of that warm Aussie hospitality.

- **8, 9 & 10. Springer Verlag**

  Sweetapple House
  Catteshall Road, Godalming
  Surrey, GU7 3PH, UK
  Tel: 01483 418 800
  Fax: 01483 415 151
  Email: postmaster@svl.co.uk
  Contact: David Anderson

  Springer Verlag, an international publishing house with offices in Berlin, Heidelberg, London, New York, Barcelona, Budapest, Hong Kong, Milan, Paris, Santa Clara, Singapore and Tokyo, is the world's leading publisher in the field of mathematical sciences. Renowned for their scientific integrity and production quality, Springer's books, journals and electronic products have inspired mathematicians in the closing century of this millennium and stand poised to carry on this tradition to new generations of mathematicians into the next millennium.

- **11. Engineering and Physical Sciences Research Council (EPSRC)**

  Polaris House
  North Star Avenue
  Swindon SN2 1ET, UK
  Tel: +44 (0)1793 444304
  Fax: +44 (0)1793 444456
  Email: Alasdair.Rose@epsrc.ac.uk
  Contact: Dr Alasdair Rose, Programme Manager, Mathematics

  The Engineering and Physical Sciences Research Council is the largest of the United Kingdom's seven government-funded research councils. Its mission is to support the highest quality research and related postgraduate training in engineering and the physical sciences. EPSRC aims to advance

knowledge and technology and provide trained engineers for the benefit of the United Kingdom and the quality of life of its citizens. It has the further role of promoting public understanding in engineering and the physical sciences. The budget of the EPSRC Mathematics Programme is £14 million which funds 200 masters and 550 doctoral students, personal research fellowships (7 junior, 35 advanced and 5 senior), postdoctoral research assistants, short-stay visiting fellows, symposia and workshops.

- **12. Oxford University Press**

  Great Clarendon Street
  Oxford OX2 6DP, UK
  Tel: 01865 556 767
  Fax: 01865 556 646
  Contact: Henry Reece, Secretary to the Delegates and Chief Executive

  OUP is an international publishing house dedicated to the advancement and spread of learning in all academic fields including science, technology and medicine. Publications cover the range of the academic spectrum from elementary college textbooks and books for the general reader; practical handbooks and reference works for professionals; through to specialised academic monographs and scholarly journals.

- **13. The Institute of Mathematics and its Applications (IMA)**

  Catherine Richards House
  16 Nelson Street
  Southend-on-Sea SS1 1EF, UK
  Tel: +44 (0)1702 354020
  Fax: +44 (0)1702 354111
  Email: post@ima.org.uk
  http://www.ima.org.uk
  Contact: Adrian Lepper, Executive Secretary

  The Institute of Mathematics and its Applications is a learned society and the professional institute for mathematicians in the UK. Its membership of 6000 work in industry, commerce, the public sector, schools, further and higher education. The institute publishes six journals, a general interest publication Mathematics Today, has local branches and special interest groups and has a wide ranging conference programme. The Institute represents the interests of UK mathematicians to government and statutory bodies.

- **14. EDP Sciences**

  7 avenue du Hoggar, BP 112
  Parc d'Activities de Courtaboef
  F-91944 Les Ulis Cedex A, France
  Tel: 33 169 18 75 75
  Fax: 33 169 28 84 91
  http://www.edpsciences.com
  Contact: Nathalie Lecrosnier

  EDP Sciences was established in 1920 by Paul Langevin. It is one of the main French publishers in the field of physics. La Société Française de Physique is the major shareholder of EDP Sciences. Now EDP Sciences tends to cover a larger field, including astrophysics and astronomy, materials science, metallurgy, acoustics, chemistry and mathematics. Listed below are some French learned societies, beside SFP, collaborating with EDP Sciences: Société Française d'Acoustique; Société Française des Hautes Températures; Société Française de Métallurgie et de Matériaux; Société Française des Microscopies; Société Française de Radio protection; Société Française de Chimie.

- **15 & 19. The Numerical Algorithms Group Limited (NAG Ltd)**

  Wilkinson House
  Jordan Hill Road
  Oxford OX2 8DR, UK
  Tel: 01865 511 245
  Fax: 01865 310 139
  Email: sales@nag.co.uk
  Contact: Liz Jupe, Marketing Communications Manager

  NAG Ltd has almost thirty years experience in developing, porting, distributing and supporting scientific software. Renowned for the accuracy and robustness of its software, NAG is the world's leading supplier of numerical and statistical subroutine libraries. The libraries are the largest collection of proven, well-tested routines covering a broad range of mathematics and statistics. NAG also provides a range of programming tools and compilers, as well as visualisation packages for professionals in industry and education. All of NAG's software is fully supported by the developers themselves, providing customers with comprehensive technical support. NAG Ltd is based in Oxford, UK, with subsidiary companies in Chicago, Munich and Tokyo as well as distributors worldwide.

- **16. Kluwer Academic Publishers**

  Spuiboulevard 50
  3311 GR Dordrecht, The Netherlands
  Tel:+31 78 6393 121
  Fax:+31 78 6392 323
  Contact: Suzanne Schalken

  Kluwer Academic Publishers is one of the world's most prominent research level/academic publishers specialising in Science, Technology, Medicine, the Humanities, Behavioural and Social Sciences.

Kluwer Academic Publishers incorporates the Science and Technology program's of Chapman and Hall, Plenum Publishing (now Kluwer Academic Publishers) and Kluwer Law International.

- **17. To be confirmed**

- **18. Elsevier Science**

  Elsevier Science
  P O Box 211
  1000 AE Amsterdam
  The Netherlands
  Tel: 31 20 485 3798
  Fax: 31 20 485 3809
  Contact: Mrs U van Dijk

  For over 100 years Elsevier Science has been dedicated to facilitating the exchange of scientific information. Stop by our booth to see how you can win 6 months FREE ELECTRONIC ACCESS to your favourite applied mathematics journals. Of course, a wide range of our journal and book publications will also be available for you to browse through and take away. Our staff will be happy to answer any questions you may have and look forward to meeting you there.

- **20. To be confirmed**

- **21. Wisepress**

  Tel: 0181 715 1812
  Fax: 0181 715 1722
  Email: exhibitions@wisepress.co.uk
  Contact: Jerome Carroll

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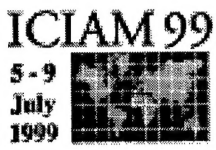

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